

*Archives of*  
**PHYSICAL MEDICINE**  
*and* **REHABILITATION**

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Editor of the Month

**ARTHUR C. JONES, M.D.**

Portland, Ore.

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To stimulate interest in the field of physical medicine and rehabilitation, the American Congress of Physical Medicine and Rehabilitation will award annually, a prize for an essay on any subject relating to physical medicine and rehabilitation. The contest, while open to anyone, is primarily directed to medical students, interns, residents, graduate students in the pre-clinical sciences and graduate students in physical medicine and rehabilitation. The Essay Award Committee suggests that members of the American Congress and American Academy of Physical Medicine and Rehabilitation bring this announcement to the attention of interested persons. The following rules and regulations apply to the contest:

1. Any subject of interest or pertaining to the field of physical medicine and rehabilitation may be submitted.

2. Manuscripts **must be** in the office of the American Congress of Physical Medicine and Rehabilitation, 30 N. Michigan Ave., Chicago 2, not later than June 1, 1957.

3. Contributions will be accepted from medical students, interns, residents, graduate students in the pre-clinical sciences, and graduate students in physical medicine and rehabilitation.

4. The essay must not have been published previously.

5. The American Congress of Physical Medicine and Rehabilitation shall have the exclusive right to publish the winning essay in its official journal, the **ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION**.

6. Manuscripts must not exceed 3000 words (exclusive of headings, references, legends for cuts, tables, etc.), and the number of words should be stated on the title page. An original and one carbon copy of the manuscript must be submitted.

7. The winner shall receive a cash award of \$200, a gold medal properly engraved, a certificate of award and an invitation to present the contribution at the 35th Annual Session of the American Congress of Physical Medicine and Rehabilitation at Hotel Statler, Los Angeles, September 8-13, 1957.

8. The winners shall be determined by the Essay Award Committee composed of four members of the American Congress of Physical Medicine and Rehabilitation.

9. All manuscripts will be returned as soon as possible after the name of the winner is announced.

10. The American Congress of Physical Medicine and Rehabilitation reserves the right to make no award if, in the judgment of the Essay Award Committee, no contribution is acceptable. The Congress may also award certificates of merit to contributors whose essays may be considered second and third best submitted. Announcement of the winner will be made at the annual meeting.

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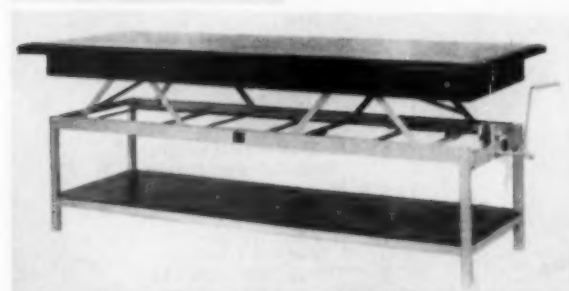
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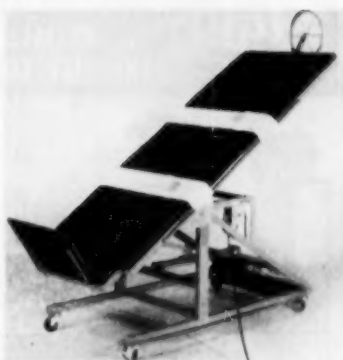
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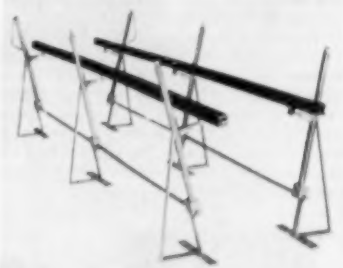
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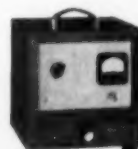
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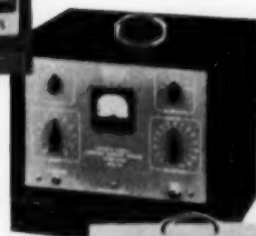
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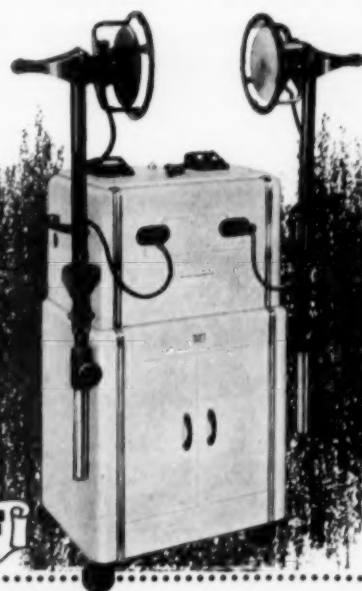
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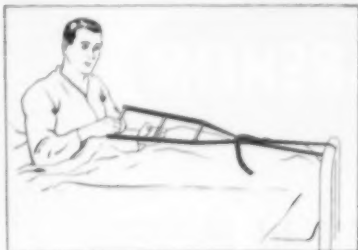
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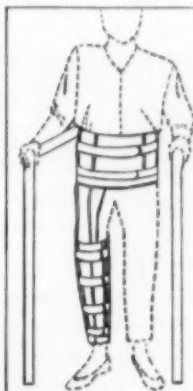
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# Rehabilitation of the Aphasic Patient: A Survey of Three Years' Experience in a Rehabilitation Setting

Morton Marks, M.D.

Martha Taylor, M.A.

and

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The management of the patient with aphasia is one of the most complex and difficult problems that the rehabilitation worker encounters. The primary emphasis of earlier investigators and others who have contributed to the voluminous literature has been usually devoted to a discussion of the pathogenesis, classification, clinical features, and their theoretical implications as to the functional capacities and localization of function within the human brain. The two world wars with their harvest of patients with aphasia secondary to cranial injury, however, stimulated exploration of the retraining potential of this group and the details of many comprehensive programs and their results have been described by many authors.<sup>1</sup> Despite the more common occurrence of hemiplegia and the frequently associated concomitant language difficulty secondary to the disease, comparable extensive compilations of experiences gained from the reeducation of the patient with aphasia resulting from disease are lacking. Most of the published appraisals of aphasia secondary to disease are of such small numbers of patients as to be of questionable scientific and statistical significance.

Opinions as to the functional value of the rehabilitation program for the aphasic are varied. Some would contend that the program has no significant influence on the rate of improvement, but rather consider improvement to represent spontaneous recovery or spontaneous reorganization of the residual cerebral functional capacity. Others, including Goldstein, Butfield and Zangwill, and Weisenburg and McBride believe that retraining procedures may appreciably initiate or increase the rate of improvement.<sup>2</sup>

When objective studies are undertaken in an attempt to clarify the problem, many difficulties become apparent. Controlled long-term studies utilizing comparable groups, one given and the other not exposed to therapy, are lacking. In addition there are no clearly formulated criteria of what constitutes the "normal" spontaneous restitution of function following aphasia, or beyond what period of time spontaneous restitution of function can occur. Moreover, there is no uniformity or standardization of the materials or the procedures to be followed in retraining the aphasic or even unanimity of the implied underlying philosophy. Many attempt speech retraining based primarily on a phonetic and mechanical approach. Others attempt having the patient relearn speech patterns utilizing successively more complex Gestalt conceptualizations.

One formidable aspect of the problem is that no universally accepted and standardized testing procedure exists with which the degree of functional deficit and the extent or rate of subsequent improvement or return of function can be accurately graded and classified. The technic of using comparatively the pre-existing and subsequent functional capabilities, such as school grade levels, in evaluation of those who sustained their injuries during military service can only rarely be utilized for the patient encountered in civilian life.

Another important and, at times, overlooked factor is the unique psychological status of each aphasic patient. Because

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of the communication difficulty, the usual psychological and psychometric testing technics prove inadequate. The correlated problem of the patient's motivation and the important role the speech therapist may play in developing it are well recognized but have not as yet been clearly formulated or controlled in any appraisal of the effects of therapy.

In view of these difficulties, it is not surprising that the clinician varies in his concept of the management of and value of a speech program for the aphasic patient, ranging from an attitude of unbridled enthusiasm to one of therapeutic nihilism in many instances. This paper is an attempt to critically evaluate the results of and factors encountered when the facilities of the rehabilitation center are utilized in attempting reeducation of the patient with aphasia as he is commonly encountered in medical practice.

#### Case Material and Procedures

A series of 324 patients evaluated and/or treated during the preceding three-year period at the Institute of Physical Medicine and Rehabilitation, New York University-Bellevue Medical Center, in the speech department, comprise the basis for this study. All of the patients were considered to have had some form of speech disturbance associated with organic brain disease and premorbidly were considered to have had "normal" language function.

Referral sources included private physicians, welfare agencies, private speech therapists, other hospitals, and families of aphasic patients. The patients were referred to the speech department, however, only after a comprehensive medical review to ascertain whether or not further definitive medical care was indicated. Most of the patients were admitted for a total rehabilitation evaluation, but occasionally patients were admitted only for speech evaluation and treatment.

The speech evaluation included a psychological work-up, pure-tone audiometric sweep testing, the Halstead-Wepman aphasia screening test, a family interview, a patient interview in the presence of the family, a patient interview without the family being present,

and an evaluation of his functional ability, that is, of his language abilities incident to the functions of daily living, such as telephoning, writing his name, and so forth.

The diagnostic classification included:

1. Predominantly expressive-type aphasia, in which the greatest difficulty exists in the expressive areas of language and might include part or all of the modalities of communication.
2. Mixed or expressive-receptive type aphasia, in which there seemed to be equal involvement of both the expressive and receptive functions of language.
3. Predominantly receptive type aphasia, in which the primary difficulty appeared to be in comprehension.
4. Global aphasia, in which there appeared to be no language capacity in the expressive or receptive areas of communication.<sup>3</sup>

The functional classification included:

1. Vocational adequacy in language. These patients were considered adequate enough to qualify for vocational placement, although not necessarily in their former vocation.
2. Home adequacy in language. These patients were considered adequate for functioning at home, that is, they were able to make their daily wants known and had sufficient receptive ability to manage the telephone, read, understand signs, and so forth.
3. Rehabilitation center adequacy in language. The patient was considered able to follow a program. He had adequate comprehension to allow him to attend group and individual classes. He could use the elevator without assistance, and would follow nurses' and therapists' instructions.
4. Institutional adequacy in communication. The patient was unable to perform in any of the higher-level functional activities.

The evaluation findings were presented to the medical resident in charge of the patient and presented at the time of the staff evaluation of the patient. The decision as to whether or not to institute language retraining usually reflected the combined opinions of the

Table 1

Total Aphasiacs	Expressive	Receptive	Expressive-Receptive	Global	Dysarthria	None	Unknown
Male 136 (62.1%)	94	7	27	8	65 (29.6%)	18 (8.2%)	3
Female 69 (32.7%)	53	1	12	3	32 (29.1%)	9 (8.2%)	1
Totals 205 (62.4%)	147	8	39	11	97 (29.4%)	27 (8.2%)	4
% Aphasiacs	(71.7%)	(3.9%)	(19.0%)	(5.4%)			

Table 2

Cause	Total Aphasiacs	Expressive	Receptive	Expressive-Receptive	Global
Trauma	13 (6.4%)	10	1	2	0
Disease	190 (93.6%)	137	6	27	10

Table 3

Age	Total Aphasiacs	Expressive	Receptive	Expressive-Receptive	Global
Under 30	14 (6.9%)	13	0	1	0
30-40	16 (7.9%)	14	0	1	1
41-50	43 (21.2%)	33	3	7	0
51-60	48 (33.7%)	50	0	15	3
Over 60	61 (30.2%)	34	5	17	7

resident, the physician in charge, and the speech pathologist, and were frequently influenced by the neurological and psychological problems uncovered. The actual technics and type of retraining to be utilized were usually determined by the speech pathologist. Although theoretically the evaluation process was accomplished in one session, in actuality the evaluation process was most commonly performed concurrently as part of a trial period of therapy. An attempt at the prognosis was made during the evaluation. However, it was recognized that this was primarily a subjective assessment of the patient's potential and its confirmation depended upon a trial period of therapy.

The diagnostic and sex distributions are tabulated in table 1.

It should be noted that the numbers of patients recorded totaled 333. This is explained by the fact that nine aphasic patients were also considered to be dysarthric and classified in both groups (eight expressive and one receptive). The preponderance of men over women in this series was not considered significant, as this was approximately the ratio of admissions to the service during the period of study.

Disease processes, primarily cerebrovascular accidents, were considered to be the underlying cause in 93.6 per cent of the cases (table 2).

Table 3 records the age distribution. The incidence was noted to be the highest after 50 years.

Vocational and educational surveys showed wide scattering of the patient population and were not considered significant (table 4).

Table 4

Total Aphasiacs	Vocation
37	Professional
15	Semi-professional
22	Owner, executive, large business
19	Small-business owner
24	White-collar worker
12	Skilled laborer
12	Unskilled laborer
42	Housewife
4	Student
18	Unclassified

Their known educational backgrounds were widely scattered (table 5).

Handedness is recorded in table 6. It must be borne in mind that handedness does not unequivocally imply language laterality in the contralateral hemisphere.<sup>4</sup> In this series laterality was determined by asking the patient or family which hand the patient commonly used for performing normal functional activities.<sup>2</sup> It was recognized that writing was the result often of a specialized training technic and was therefore not an absolute indicator of handedness. The

true incidence of left handedness among the general population is unknown. Most estimates are in the region of 5 per cent, with surveys reporting a decreasing frequency of left handedness with increasing age.<sup>5</sup>

The commonly associated physical disabilities are tabulated in table 7.

Table 5

Total Aphasians	Education
38	Unknown
21	Under 6 years
12	6-7 years
11	8 years (grad.)
7	9-11 years
68	12 years (grad.)
16	13-15 years
37	16 years

Detailed case studies relating handedness and inferred language laterality, physical disability, and aphasia have been recorded by numerous authors. The accumulated studies, as do our findings, tend to corroborate Goodglass and Quadfasel's conclusions that cerebral laterality for language and handedness are not directly linked, and one does not determine the other.<sup>4</sup> The present series includes cases of aphasia in right-handed individuals who had right cerebral involvement, left handed individuals with left cerebral involvement, and left handed individuals with right cerebral involvement. Although their incidence was small, these occurrences add additional evidence to that previously accumulated which questions the validity of the concept of strict localization of cerebral functional capacities.

Table 6

Handedness	Total Aphasians	Expressive	Receptive	Expressive-Receptive	Global
Right	196 (97%)	141	8	37	10
Left	6 (3%)	4	0	1	1

Table 7

Physical Disability	Total Aphasians	Expressive	Receptive	Expressive-Receptive	Global
Right hemiplegia	183 (90.6%)	132	8	35	8
Left hemiplegia	7 (3.5%)	4	0	2	1
Ataxia	4 (2.0%)	2	0	1	1
None	8 (4.0%)	7	0	0	1

Table 8

Duration of Symptoms, Months	Total Aphasians	Expressive	Receptive	Expressive-Receptive	Global
Less than 1	9	8	0	1	0
1-2	25	19	0	4	2
2-3	23	13	3	3	4
3-4	14	11	0	3	0
4-6	31	18	0	13	0
6-9	23	13	1	8	1
9-12	15	11	1	2	1
12-24	23	19	0	3	1
Over 24	41	35	3	2	1

Table 9

Previous Speech	Total Aphasians	Expressive	Receptive	Expressive-Receptive	Global
None	162	118	5	39	9
Less than 2 weeks	1	0	0	1	0
2-4 weeks	1	1	0	0	0
1-2 months	7	4	1	1	1
2-3 months	6	3	1	2	0
More than 3 months	23	18	0	4	1



The duration of the aphasia prior to the patient's evaluation is shown in table 8.

It should be noted that 50 per cent of the patients sought therapy or were appraised six months or more after the onset of symptoms. Only 27.8 per cent of the total were seen within three months after the onset. This is of special interest since the period of spontaneous restitution of function is usually considered to be less than six months after the onset of the illness. Expressive aphasiacs as a group sought therapy later than those with receptive components.

Few of the patients had had previous speech therapy. Eighty-one per cent had had no therapy; 7.5 per cent had therapy of less than three months; and 11.5 per cent had had therapy of more than three-months' duration (table 9).

Most patients (62.5 per cent) preferred outpatient status (table 10). A higher percentage of the more severely involved aphasiacs sought inpatient care. Whereas 29.9 per cent of the expressive aphasiacs were inpatients, 33 out of 58

(56.9 per cent) of aphasiacs in other categories were inpatients.

The number of therapy sessions varied from none to more than 110. The scatter is evidenced in table 11. Forty patients (20 per cent) had no therapy; only 79 (39.5 per cent) had more than 21 therapy sessions.

The duration of therapy, too, varied widely (table 12).

After discharge from the Institute many patients were referred for further programs. The type of program the patient actually carried out was determined through a recheck or by telephone contact with the patient one month after discharge to determine whether or not he had continued with the recommendations (table 13); 48.5 per cent of the patients continued with some form of program, usually at home.

The treatment program was generally set up as follows. Individual sessions were limited to one-half hour per session. They were held in quiet, private quarters where there was a minimum of distraction. Attempts were made to offer

Table 10

Status	Total Aphasiacs	Expressive	Receptive	Expressive-Receptive	Global
Inpatient	77	44	3	22	8
Outpatient	128	103	3	17	3

Table 11

Sessions	Total Aphasiacs	Expressive	Receptive	Expressive-Receptive	Global
None	40 (20.0%)	28	1	9	2
1-10	50 (25.0%)	36	3	8	3
11-20	31 (15.5%)	25	0	5	1
21-30	25 (12.5%)	15	2	6	2
31-60	28 (14.0%)	18	2	5	3
61-90	12 (6.0%)	8	0	4	0
91-110	2 (1.0%)	2	0	0	0
More than 110	12 (6.0%)	11	0	1	0

Table 12

Duration of Therapy, Months	Total Aphasiacs	Expressive	Receptive	Expressive-Receptive	Global
None	40 (20.2%)	28	1	9	2
Less than 1	51 (25.8%)	33	2	11	5
1-2	43 (21.7%)	28	2	10	3
2-3	26 (13.1%)	20	2	3	1
3-6	24 (12.1%)	20	0	4	0
6-9	19 (9.5%)	8	1	1	0
9-12	2 (1.0%)	2	0	0	0
Over 12	2 (1.0%)	2	0	0	0

Table 13

Type of Therapy Continued	Total Aphasiacs	Expressive	Receptive	Expressive-Receptive	Global
None	102 (51.6%)	68	4	25	5
Home	66 (33.3%)	46	2	8	3
Clinic	5 (2.5%)	2	0	3	0
Professional	31 (15.7%)	25	1	2	3

Table 14

Results	Total Aphasiacs	Expressive	Receptive	Expressive-Receptive	Global
Excellent	11 (6.9%)	9	1	1	0
Good	35 (22.6%)	32	0	2	1
Fair	34 (21.4%)	25	1	6	3
Poor	79 (49.7%)	49	4	21	5

therapy early in the day before the patient fatigued. The equipment used included numerous objects, object pictures, object flashcards, phrase flashcards, sentence flashcards, a blackboard, and audio-visual devices. The latter included a large toy clock with moveable hands; a tape recorder for advanced patients; adult grammar education reading material for advanced patients; block letters; word lists; materials from the *APHASIA MANUAL*<sup>6</sup>; the "Language Master," an audiovisual device capable of reproducing specific structured visual material like nouns, phrases, and sentences in auditory form through ear phones or in a free field through a speaker, and occasionally a mirror for patients with verbal apraxia.

Many technics of actual therapy were employed, such as matching of pictures, objects, and words. Naming was attempted through repetition, imitation, by copying writing, through dictation, and stimulation of the patient's identification. Calculations were performed using such devices as flashcards, quantities of similar objects, and number games. Reading was attempted by first using flashcards with nouns and later using simple adult education readers. Writing was performed by first tracing and using block letters, and finally writing from dictation. Conversation was utilized extensively to enhance the functional carry-over of the learned material. Auditory stimulation was offered to the patient in large amounts to stimulate speech production. Finally, functional technics such as using the telephone in a controlled clinical set-

ting, writing letters to friends, and ordering from actual menus were employed.

Evaluations and measurements of progress were based almost entirely on the patient's increased functional ability. For a patient who had a long term of therapy, the original Halstead-Wepman form was readministered. The patient's own expressions were frequently used as indicators of his progress.

Treatment was terminated when it was considered that the patient had reached his maximum level of language functioning; usually this would be determined by the combined opinions of the physician in charge and the speech pathologist. Other causes for termination of therapy included disinterest of the patient in continuing therapy, or the unfortunate inability of the patient to further finance speech therapy.

In most instances, at the time of discharge a home program was given to the patient as a supportive therapeutic measure, even when it was believed that he had attained his maximal language level; in addition, there was always the possibility that he might increase his functional language ability.

Attempts at evaluation of treatment results are obviously difficult. Our criteria of classification were defined as follows:

1. Excellent:
  - a. Patient moved from one functional level to another during treatment.
  - b. Patient moved from one diagnostic level to another.
  - c. Patient acquired such a significant amount of increased language skill that, although he remained in one

classification, he was judged to have made marked functional changes.

2. Good: Patient moved from either one functional level or one diagnostic level to another.
3. Fair: Patient did not move from one functional category to another either functionally or diagnostically but did make some functional gains within the original categories.
4. Poor: Patient exhibited no changes during treatment in functional language ability.

Evaluations were performed by three speech therapists. In all cases, for classification, two out of the three had to share the same opinion. The results of treatment are tabulated in table 14. The results obtained, although not as favorable as those reported by others whose patients had aphasia primarily resulting from trauma, appear to be of significance and warrant a reeducation regimen for the aphasic. The best results were observed in the expressive aphasic patient.

### Discussion

Study of the individual cases revealed many additional interesting facts. Although treatment results appeared to be better in the younger groups, age alone did not preclude favorable results.

A relatively long duration of symptoms does not mitigate against successful therapy, although favorable results seemed to be more common when therapy was instituted earlier. One of the markedly expressive aphasic patients made only slight functional improvement during the first year of his reeducation program, although therapy, which consisted primarily of a comprehensive home program with frequent check-ups, was instituted within one month of the onset of his illness. He gradually started to improve to the point of virtual recovery. He has returned to his occupation as a top research chemist with a large organization, in charge of a department, capable of carrying out all his required activities, including lecturing. Another patient, a woman who had failed to show signifi-

cant gains during her first year of therapy, returned to such a high level of functional activity that she was considered to be one of our most successful results. We have learned that even small gains, if sustained, may warrant additional training.

It was our feeling that those patients whose personality structure was and had been a relatively rigid one, with compulsive features, tended to do less well therapeutically than did other patients whose personality had been considered premorbidly to be less restrictive. Further studies in this sphere are contemplated.

It must be noted too that our treatment facilities were encompassed in a comprehensive rehabilitation setting in which the emphasis was on retraining and rehabilitation of the "total" patient. The process of reeducating the aphasic patient was directed not only at the speech disability, but rather required consideration of the total language or communication disturbances. This then was combined in many instances with a comprehensive physical program. The results as recorded seem encouraging enough to warrant the extension of such services to a large number of aphasic patients encountered in our communities, despite the handicaps of age, disease, and relatively long duration of symptoms.

### Summary and Conclusions

Two hundred and five aphasic patients who had been evaluated and/or treated at the Institute of Physical Medicine and Rehabilitation in the speech department comprise the basis for this study. Only a small percentage of these had traumatically incurred aphasias. In all cases aphasia as a diagnostic term is used to describe patients with language disturbances who premorbidly had normal language. The age range of the patients varied from 3 to 80 years. Such factors as vocational status, education, handedness, physical disability, previous speech therapy, number of therapeutic sessions, length of therapy, time lapsed before coming to the Institute, rated degree of recovery, type of continued therapy, and cause of aphasia are data included in the statistical survey.

The results seem to indicate that a comprehensive language retraining program will often prove to be of significant functional value to the patient, especially the one with a predominantly expressive type of aphasia. Therapeutic nihilism on the part of the physician, family, or patient himself may well be a disservice to the patient; however, therapeutic goals must nevertheless be realistic.

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# Rehabilitation Center Concepts' Change in Practice

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Washington, D. C.

To the uninitiated, a rehabilitation center is a place where all rehabilitation, no matter how difficult, can be accomplished under one roof. This has led to a widespread demand for rehabilitation centers as an answer to all of a community's rehabilitation problems. But the concepts of rehabilitation are so broad and the role of the center has changed so much that a decision just to have or not to have a center is not enough. Unless its need is clearly documented and its functions and relationship to the rest of medicine and the rest of rehabilitation well understood, failure and disillusionment may follow.

## The Rehabilitation Center — a Dynamic Concept

Rehabilitation has been well defined as the process of "restoring the handicapped to the greatest physical, mental, social and vocational usefulness of which they are capable." The rehabilitation center can contribute greatly to the rehabilitation of the severely handicapped in particular. The rehabilitation process has itself evolved from much simpler beginnings when the finding of a job, any job, for a handicapped person was the principal objective. So, too, the concept of a rehabilitation center that telescopes part of the rehabilitation process has evolved from ideas tried and found wanting.

The rehabilitation process properly extends from the date of injury or onset of crippling disease to the attainment of maximum adjustment to the disability in terms of the foregoing definition. At various points in the rehabilitation process, it is possible to bring together a concentration of highly specialized services that are well integrated. Such is the program of a rehabilitation center.

Few of the so-called one-roof centers of an earlier day were equipped to pro-

vide all the services of modern rehabilitative medicine. Usually they were predicated upon the erroneous idea that rehabilitation begins after most or all definitive medical care has been completed.

Early centers tended to train around a disability without first thoroughly exploring the possibilities of reducing it through more extensive medical procedures. Too often such medical help was unavailable.

The current concept of a center calls for a concentrated and simultaneous approach to all the major problems associated with disability, be they medical, psychological, social, or vocational, and special emphasis is placed on a total rehabilitation evaluation. The concept assumes that a number of very important services both precede and follow the relatively short and concentrated experience in a center, and it seeks to relate these to the intensive work in the center.

The distinction between the old one-roof idea and the present practice lies in acceptance of the very great importance of related rehabilitation services outside the center. Many of these are highly specialized medical procedures that precede treatment in the center and many are equally specialized vocational services that may follow treatment there. In today's center, the staff does not try to solve all the problems but it makes a great effort to pull together, interpret, and use previous services as well as prepare the patient for procedures that will come later.

Most of all, it seeks to see the patient whole and to help him understand and deal effectively with all facets of his prob-

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The opinions expressed are those of the author and should not be construed to reflect the official attitude of the Office of Vocational Rehabilitation.

lem—medical, psychological, social, and vocational. Experience has shown that many services in these four areas can best be given concurrently if the patient is to profit most from them. Finally, the center with its diversified staff of specialists in the four areas mentioned previously, can evaluate, and is increasingly evaluating, rehabilitation potential for many patients who can secure all necessary specialized services outside the center, provided an overall plan is developed first.

Though it is no longer possible to house all of the rehabilitation process under one roof, a very great need remains for the integrated approach to the tremendous problems faced by the handicapped individual. Much is to be gained if early in his rehabilitation, but not necessarily at the beginning, there is not only integration of planning but integration of service through the provision of concurrent services. Concurrent service means that, while physicians are treating physical restoration problems, social workers, vocational counselors, psychologists, and others on the center's staff are also exploring, treating, and helping the patient solve problems they are specially qualified to deal with.

Successful rehabilitation, particularly of the severely handicapped, requires teamwork among many medical and related specialties. With this recognition is a corollary of equal importance. No longer do we dare to equate one discipline with the totality of services required in rehabilitation. Indispensable as it is, medicine alone cannot rehabilitate, nor can occupational therapy, vocational counseling, vocational training, psychology, or social service.

The interdependence of disciplines lies at the heart of the modern concept of a comprehensive rehabilitation center. In a center, the area reserved for any particular discipline tends to be reduced. More disciplines are added and increasingly the practitioners of these disciplines all work together. As a result, each discipline is practised somewhat differently in a comprehensive center than in other situations.

The definition of a comprehensive rehabilitation facility, which appears in

both the Medical Facilities Survey and Construction Act of 1954 (amended Hill-Burton Act, Public Law 482), and the Vocational Rehabilitation Act, also enacted in 1954 (Public Law 565), is consistent with this concept of interdependence. The definition reads: "... a facility which is operated for the primary purpose of assisting in the rehabilitation of disabled persons through an integrated program of medical, psychological, social and vocational evaluation and services under competent professional supervision, and in the case of which (1) the major portion of such evaluation and services is furnished within the facility . . . and (2) all medical and related health services are prescribed by or under the general direction of persons licensed to practise medicine or surgery in the States."

Through the construction authorized by Public Law 482 and the increased expansion of state rehabilitation programs and services inaugurated under Public Law 565, we are beginning to see new form and substance given to today's concept of what a rehabilitation center should be and how it should function.

Along with the swing away from the one-roof concept of the early vocational center with its underemphasis on medical services, an overemphasis on the medical aspects developed. Some physical medicine departments began to call themselves rehabilitation centers. Some even came to believe that rehabilitation and physical medicine were synonymous. Rehabilitation was sometimes spoken of as a medical specialty. Such overemphasis can well endanger or even make impossible the integration of services designed to "restore the patient to the greatest physical, mental, social and vocational usefulness of which he is capable." Vocational services, for example, are by no stretch of the imagination, medical; however, they are essential in the broader concept of rehabilitation.

The aforementioned legal definition of a rehabilitation center—with its requirement for balanced services—represents a shift away from the primarily medical center, just as it is a shift away from the earlier concept of a one-roof center that



was primarily vocational. Under Public Law 482, a comprehensive center must provide the all-important comprehensive evaluation and a number of essential services in each of the four basic areas—medical, psychological, social, and vocational. These services must be offered on an integrated basis through teamwork among specialists in several disciplines.

Public Law 482 does not require that a center shall provide definitive vocational training. Few hospitals, for example, could provide this service, but a rehabilitation center in *any* setting can provide those vocational services that can most feasibly be carried on concurrently with medical, psychological, and social services. These are vocational counseling and prevocational programs.

#### Current Status of Rehabilitation Center Construction Program

Public Law 482 provided for the first time for federal assistance in the construction of rehabilitation facilities. This year, \$4 million is available to the states for this purpose. Federal funds are channeled through the state hospital construction agencies (usually the state departments of health) and the federal money used for constructing a facility must be matched on a formula prescribed in the law. Such matching funds may come from either public or voluntary sources.

Provisions in Public Law 482 thus tie in very closely with those of the Vocational Rehabilitation Amendments of 1954 (Public Law 565) in that the latter provide for federal grants to public and private groups for the *expansion* of rehabilitation facilities. Public Law 565 does *not* provide for federal aid to projects involving initial basic construction of facilities.

As of June 30, 1956, 42 projects in 35 states had been approved for almost \$5.5 million dollars in federal assistance in the construction of comprehensive centers under the Medical Facilities Survey and Construction Act. Over \$1 million dollars had also been distributed through state vocational rehabilitation agencies for establishment of rehabilitation facilities, mostly of the noncomprehensive type and including many sheltered-employment projects.

Never in the history of rehabilitation has there been such co-operation among voluntary groups, the state health departments, the state vocational rehabilitation agencies, and the federal government to produce facilities all across the land for the purpose of rehabilitating our handicapped citizens. There have been rivalries and problems, but the facilities are coming into being in every state. If in the years ahead they are used as they should be in the same co-operative fashion, more handicapped people, especially those severely so, will be rehabilitated than ever before.

Although Public Law 482 provides only for the construction of comprehensive centers, it should not be implied that the comprehensive center is the only type of rehabilitation facility needed. Assistance in establishing the noncomprehensive facility is provided for in the Vocational Rehabilitation Act (Public Law 565), and in the hospital construction portions of the original Hill-Burton Act. One such additional type is the physical medicine department in a hospital, which is adequate for many patients if their problems are primarily medical. Another needed type is the treatment center, which in effect is a community pool of scarce physical medicine resources. Such a center is often established when no one hospital can develop a physical medicine department that will be used by all hospitals and physicians in the community. Still another is the sheltered workshop that serves the very severely handicapped after they have received services in the comprehensive center. Prolonged vocational services in such a workshop are often necessary before the severely disabled can enter competitive employment.

When a community has a variety of rehabilitation facilities, the staff members of each can gain a great deal by giving consultation service to the other. The physician in a physical medicine department of a hospital is a valuable consultant to a comprehensive rehabilitation facility. The vocational counselor in a comprehensive center should be used as a consultant in hospitals and physical medicine departments, and both may be useful as part-time consultants to a shel-

tered workshop or to the state vocational rehabilitation division. The patient who moves in and out of these facilities, or most likely from one to another, must inevitably benefit from this pooling of knowledge and skills.

#### Problems Involved in Rehabilitation Center Construction

To avoid confusion, the term "rehabilitation center" should be used only in reference to a comprehensive facility that provides balanced services in the four basic areas—medical, psychological, social, and vocational, regardless of whether the facility in question is free standing or part of another institution.

It is this broad concept of a rehabilitation center that underlies the construction efforts made possible in the rehabilitation field by Public Law 482. As I have already indicated, considerable progress has been made to date under the terms of the Act.

But this progress has not been without its problems. Generally speaking, it can be said that these problems fall into two broad categories. The first type of problem is that besetting hospitals and medical schools planning to provide for the required vocational services and for overall integration of rehabilitation services. The second group of problems has been those encountered by sponsors of free-standing community centers.

The hospitals and medical schools encountered difficulty in planning to provide the required vocational services and in planning for integration of services. As might be expected, medical services were well provided for. This, in itself, represents a great step forward, since it has not been many years since medicine stopped with provision of "acute" care. The vocational services necessary to a comprehensive rehabilitation center were not always well understood by medical school and hospital sponsors. Too often there was a tendency to think of rehabilitation as medical and little more.

In some instances, it was even proposed that vocational services be vaguely delegated to some other agency or institution. Some sponsors had difficulty seeing the difference between vocational

counseling, prevocational programs, and vocational training—specialties in the rehabilitation field as distinct as internal medicine and psychiatry in medicine.

In some instances, these difficulties were resolved by the inclusion of a strong and varied vocational service. All of the approved projects have included, as a minimum, vocational counseling and a prevocational unit in a vocational service that is administratively on a par with the medical and other services. Few, if any, of these centers will include such vocational services as vocational training or sheltered employment.

After vocational services have been organized and used for a time in comprehensive centers and hospitals in medical schools, their value as a part of the integrated approach to rehabilitation will be understood more fully. A good vocational service can do more than anything else to show that rehabilitation is more than just medical service. Another advantage of vocational service will be to enhance the value of these centers in training social workers, psychologists, counselors, and other rehabilitation specialists.

Among the hospitals and medical schools there has also been a tendency to scatter various rehabilitation services throughout the hospital. This is in conflict with the principle that integration in a rehabilitation center calls for the closest possible daily consultation and collaboration by all members of a rehabilitation team.

As an example of this problem, social services, one of the required four types, often were inadequately planned. It was frequently proposed that the existing social service department of the hospital would serve the rehabilitation center by being "on call." Such an arrangement is not satisfactory, since this or any other service in a center must be concentrated and integrated with the other services. Unless all services are located together and unless the staff assigned to each service has rehabilitation as its primary responsibility, integration is likely to break down. The rehabilitation center in a hospital should be thought of as a compact and integrated facility within a

facility, not as a program scattered throughout the sponsoring institution.

Like the sponsors of hospitals and medical schools, the sponsors of free-standing community centers have also had their problems. For them, the difficulty lay in the provision of adequate medical services. A number of the community centers have been providing physical medicine services without supervision by a staff physician. Public Law 482 wisely provides that all such services shall be under "competent professional supervision." Unless a physician is present in the center, competent therapists cannot easily be recruited and actual medical services cannot adequately be supervised. It is also just as important that a physician should be present in order to confer with the other members of a rehabilitation team and make his contribution in planning toward total rehabilitation services for the patient. Sponsors of community centers sometimes thought they could economize here, just as some hospitals hoped to save money by eliminating vocational areas.

The problem of medical supervision in the community center was solved by placing full responsibility for medical services in one physician. In the very small center, he might be employed part time, but he must do his work in the center and be available for staff conferences in the center on a regular schedule.

As with vocational services in a hospital rehabilitation center, it is predicted that no free-standing community center will be willing to do with less than this minimum of medical service after it has acquired operating experience.

#### **A Trend to Be Watched**

Despite the progress now being made toward the construction and greater use of the comprehensive rehabilitation center as a vital and unique step in the rehabilitation process, there is still no universal agreement on the center's role.

I believe it was Dr. Rusk who said, "Rehabilitation never again should be separated from the swift current of medical progress," which is certainly sound. But, the nonmedical portions of rehabilitation are also developing their own swift

current of progress. If we can direct both currents into the comprehensive rehabilitation center, the patient has much to gain.

The history of rehabilitation centers has clearly shown that teamwork is the very essence of their unique contribution to the rehabilitation process. Much has been accomplished, yet the new centers need very much to avoid the assumption that teamwork is automatic. To take teamwork for granted among the several medical, psychological, social, and vocational disciplines involved in rehabilitation centers is to court failure. For effective teamwork, the members must be skilled both in their professional specialty and in interpersonal relationships.

Observation of teams in action does not always reveal effective collaboration. Too often one or another discipline tends to dominate the others. There is still too much futile discussion about who should be captain of the team and not enough recognition of the truth that the best captains lead rather than command. Unless the team-working atmosphere is permissive, with all free to disagree and to contribute, the so-called "group decisions" are likely to be unbalanced and incomplete. Good teamwork presupposes more or less equally well-qualified representatives from each discipline. In the past, the team members were not equally well trained in their respective areas. Too often the supply of such well-trained personnel has been inadequate, particularly in the vocational areas. More training programs are gradually changing this, and the result should be better teamwork.

From the comprehensive centers dealing with the severely handicapped should come much of the clash of ideas, the professional stimulation, and the growth of new ideas that are needed to guide the thinking of all professions dealing with rehabilitation.

#### **Summary**

The concept of a rehabilitation center has changed. From the original "one-roof" concept there was a shift of attention to specialized medical facilities that were improperly called rehabilitation centers. The current concept stresses to-

tal rehabilitation evaluation for large numbers of handicapped in a comprehensive center, and concurrent integrated services there for the severely handicapped. A comprehensive center must include services in the four basic areas—medical, psychological, social, and vocational. However, it is not the practice to include every possible service in each of these areas but only the most essential ones necessary to give the staff a well-rounded view of the total rehabilitation needs of the patient. Essential to this concept is recognition of and integration with the many services, medical and vocational, carried on outside the comprehensive center.

The new federal legislation is based on the current concept. Both hospitals and community centers have had problems in broadening their approach so as to qualify as comprehensive centers.

There are and will continue to be many varieties of centers, but the comprehensive centers appear to offer the best hope for leadership of all professions and disciplines engaged in rehabilitation.

Teamwork in comprehensive rehabilitation centers needs improvement in practice if it is to make its anticipated great contribution to solving the problems of the severely handicapped.

#### Discussion

*Allen S. Russek (New York City):* Mr. Redkey has emphasized the dynamic concept of the rehabilitation team, its objectives, the importance of the total rehabilitation evaluation, and the close integration of the various facets of rehabilitation both in and out of the center. He also called attention to the physically handicapped as a national problem and the federal legislative program to assist in the establishment of adequate facilities for their rehabilitation.

Mr. Redkey's paper was so complete and full of well-organized information that the very important last sentence in the body of the paper is not as effective as it might be without further clarification. This sentence read as follows: "From the comprehensive centers dealing with the severely handicapped should come much of the clash of ideas, the pro-

fessional stimulation, and the growth of new ideas that are needed to guide the thinking of all professions dealing with rehabilitation." I believe this statement to be true and of great significance; therefore, I would like to offer the first "clash of ideas" in support of it. Out of my own experience, much of which was developed in a large, comprehensive center, I have learned that the concept of rehabilitation must include provision for self-perpetuation and establishment of standards of performance if it is to survive and expand. It is therefore inconceivable that a rehabilitation team, whether it exists alone or as a service in a hospital, can qualify as a center unless it is engaged in active programs of education and research.

There are two important reasons for this: the shortage of rehabilitation personnel in all categories and the relatively slow recognition and assimilation of rehabilitation by the medical profession in general. The rapid growth in the number of rehabilitation teams in hospitals in a very few years has injected a new element into hospital administration and medical practice for which many institutions and physicians were not prepared. Many of these teams faced resistance and lack of understanding and were never able to demonstrate their full potential. Some have continued to exist in token fashion on the fringe of a shaky physical medicine department. To avoid repetition of such early experiences, the educational activities of the comprehensive centers should be as broad as possible. They should include positive programs for enlightening and orienting physicians in local hospitals and communities, medical students, and specialists in other branches of medicine. Graduate courses for physicians already specializing in physical medicine are necessary. Basic, progressive training programs on a practical level for residents and participation in the training of therapists, nurses, psychologists, social workers, and vocational counselors are essential elements of good educational programs in rehabilitation. Finally, and very seriously, the actual technic of teamwork operation must be taught during the training periods, since

the grouping of individuals, per se, does not necessarily imply that a team has been established.

The minimal requirements for research in a center should consist at least of a method of continuous self-inventory and appraisal by keeping adequate records and reporting on the results of routine and special activities.

The "rehabilitation center," therefore, should provide not only the four essential services — medical, social, psychological, and vocational — but also should be equipped with personnel and facilities for conducting training and research programs. This principle is what differentiates the medical center from the hospital.

The need for rehabilitation services for the physically handicapped is still greater

than the supply of facilities and personnel to meet it. The experiences of many such teams in various types of hospitals and as community services are now well known. At this stage it appears most important to add quality rather than numbers to the ranks of those who have worked so hard to uphold professional standards in implementing the concept and philosophy of rehabilitation. This can best be achieved by encouraging the support of truly comprehensive rehabilitation centers and the development of new ones, with special awareness of the center's role in education and research. The appropriate use of federal funds can do much to solidify the great progress and gains made during the short life of rehabilitation as an organized, comprehensive service.

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## WHAT?

*35th Annual Session of the American Congress  
of Physical Medicine and Rehabilitation —*

## WHEN?

*September 8-13, 1957 —*

## WHERE?

*Hotel Statler, Los Angeles*

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# A Platform Crutch for the Severely Involved Arthritic Patient

Marvin G. Lepley, O.T.R.  
and  
Frederic J. Kottke, M.D.  
Minneapolis

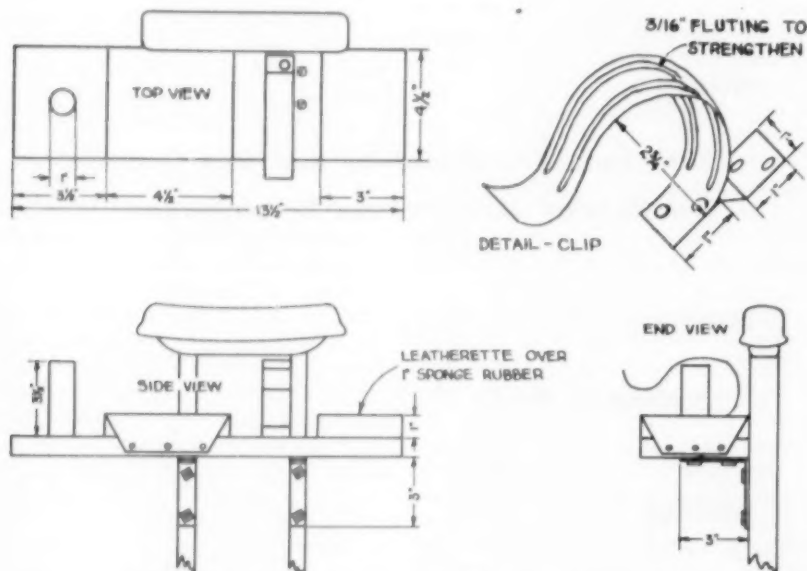
Ambulation with axillary crutches has been impossible for many arthritic patients with flexion contractures of the upper extremity. In addition, their triiceps weakness and joint pain may prevent weight bearing with the arm in the customary position. To solve this problem, a platform-type crutch such as the one pictured in Rusk's *Living with a Disability* was built and tried.<sup>1</sup> Patients had difficulty in controlling the crutch as it was moved forward because stabilization was dependent upon strong finger flexors in grasping an upright dowel.

By adding to the platform a spring clip that partially encircles the forearm,

the crutch is held in proper position and alignment while the patient advances it. Patients found the crutches easier to use when the upright dowels and platforms were positioned and shaped to their individual requirements.

Complete circling of the forearm by strap or clip should be avoided. If the patient should fall, the illustrated clip will spread readily with moderate pressure and the crutch can be discarded. Beryllium copper was used to make the

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• A SPRING CLIP PLATFORM CRUTCH •

MATERIALS:	BERYLLIUM COPPER	1" SPONGE RUBBER
3/4" FIR PLYWOOD	16 1/4" STOVE BOLTS	4 1/8" METAL RIVETS
3/4" COLD ROLLED STRAP IRON	4 R.H. WOOD SCREWS	2 DOWELS





clips because of its ease of tempering, malleability, and good tensile strength.\* It is advisable to use a nonadjustable crutch, eliminating as much weight as possible.

Sponge rubber covered with leatherette is used to pad the platform. The spring clips are elevated by a separate cleat between the two pads, eliminating pressure areas on the forearms.

Patients fitted with this crutch have been able to use it successfully. Specifications for construction are found in the accompanying drawing. Dimensions may be altered to meet the needs of the individual patient.

\*Berylco 25 alloy, .025-gage Beryllium copper was used for clips. Additional information is available through local metal product suppliers or write the Beryllium Corporation, Reading, Pa.

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## SUCCESS IS THE KEYNOTE

of our meeting this year! An interesting and scientific exhibit will contribute much to our success. In addition to the tremendous value of these exhibits, YOU have the opportunity to be considered for one of the coveted awards. Requests for applications for scientific exhibit space in connection with the 35th annual session scheduled for September 8-13, 1957, Hotel Statler, Los Angeles, are now being received. Address all communications to the American Congress of Physical Medicine and Rehabilitation, 30 N. Michigan Ave., Chicago 2, Illinois.

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## SECTIONAL MEETING ON PHYSICAL MEDICINE

The next meeting of the Midwestern Section of the American Congress of Physical Medicine and Rehabilitation will be held at the Mayo Clinic, in Rochester, Minnesota, on May 3 and 4. Those interested in attending are urged to communicate with Dr. Gordon M. Martin, at the Section of Physical Medicine and Rehabilitation, Mayo Clinic, requesting hotel reservations if they wish them.

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# A Method for Recording the Progress of Scoliosis and Other Trunk Deformities with a Review of Previously Suggested Methods

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The purpose of this paper is to present a device for measuring and recording the progress of both the lateral and rotational component of the scoliosis curve. We have found this method to be very useful in following the progression of this orthopedic deformity.

It is extremely difficult to represent graphically on a two-dimensional surface the changes that take place in scoliosis. The reason for this is, of course, that scoliosis is not a two-dimensional deformity, and the name lateral curvature, as the condition is often called, does not give a true picture of the whole condition. A method is needed that not only shows the lateral changes, as a photograph does, but also shows the rotational and torsional elements.

All orthopedic surgeons agree that scoliosis is difficult to treat. It is true that structural scoliosis is incurable in the sense that other conditions are cured, that is, restored to the original state of function, morphology, and appearance.

Difficult and prolonged treatment is always required and, in a small percentage of cases, forcible correction with surgery is necessary. This surgery is somewhat traumatic and may involve multiple stages. Even then it may require further operations for exploration and correction of pseudoarthrosis. These operative procedures are followed by long periods of immobilization. Usually it can be considered that one full year of the child's life is required for this procedure.

With these facts in mind, it is only with great precaution that surgery is performed, and many factors must be considered before a decision is made to operate. These factors are: (1) medical status of the patient; (2) developmental age of the patient, which is particularly important when the patient is nearing

the end of his spinal growth period; (3) etiology of the curvature, and (4) rate of progression of the curve.

In a majority of the cases, the exact cause is unknown. Although there are certain ages when the curves are more likely to appear, they may be present at any time during the growth period, and many times progression may cease as mysteriously as it started.

The onset and cause of paralytic scoliosis is determinable, but this form also progresses to different degrees in different cases. It is not possible to know in advance the extent of deformity to follow. Since this patient is apt to be plagued with weak respiratory muscles (if the damage to the cord was in an area causing scoliosis), the period of convalescence following surgery is more likely to be complicated, and the decision as to whether to operate still looms as the major one.

It is unnecessary to operate on a person whose curve is not severe and is not progressing, but it would be no less a mistake to allow a curve to progress and become severe when there are procedures that can halt the progression or correct the curve in a large percentage of cases.

It is with the latter of the four items listed previously, that is, rate of progression of the curve, that this paper primarily deals.

The need for a method of following and recording the curvature is not a new concept. In the earliest medical literature methods were presented for following the curve changes. The large number of methods utilized (see tables 1 to 4) is

The author received the 1956 Annual Essay Award of the American Congress of Physical Medicine and Rehabilitation for this study.

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Table 1: Current Methods of Following Scoliosis Curves

Arkin <sup>8</sup>	Photographs and x-rays. Measuring and recording the degrees of the curve at three-month intervals.
Cobb <sup>6</sup>	Fill out scoliosis form. Make photographs of front, back, side and bending. X-rays 14 x 17 or larger, standing, sitting, and supine. Protract and record the degrees of the curve. Repeat at three-month intervals.
Kleinberg <sup>10</sup>	Photographs and x-rays taken at frequent intervals.
Lackum, von <sup>11</sup>	Sketches, photographs, and x-rays. AP views of the whole spine, both lying and standing. Protractor measurements of all the curves. Standing and sitting height. Vital capacity in severe curves or when surgery is expected.
Osmond-Clarke <sup>12</sup>	X-rays (AP and tilt films) with accurate measurements of the curves.
Risser <sup>13</sup>	X-rays and photographs. Special attention is paid to the excursion of the iliac apophysis.
Steindler <sup>14</sup>	Photographs through a wire screen.

Table 2: Methods Used Formerly for Following Scoliosis Curves

	Date	Lateral	Rotational	Special Apparatus
Truslow <sup>15</sup>	1943	Plaster strip or wide tape with plumb line from spine of 7th cervical vertebrae to coccyx.	Rotometer	Rotometer
Sova <sup>16</sup>	1937			Zelenin Frame
Bouyala <sup>17</sup>	1936			Eclimeter
Saxl <sup>18</sup>	1933			
Thomsen <sup>19</sup>	1933			Simplified Kyrtometer
Moser <sup>20</sup>	1933	X-ray of patient, with spine under slight traction, placed on inclined table.		X-ray with inclined table
Bettmann <sup>21</sup>	1930			
Nedrigailowa <sup>22</sup>	1929	Kyphoscoliometer	Kyphoscoliometer	Kyphoscoliometer
Treves <sup>23</sup>	1928			Rachimeter
Bohne <sup>24</sup>	1928	Scollograph (pantogram)		Scollograph
Gaugele <sup>24</sup>	1927			
Satzepin				
Abarbanel <sup>25</sup>	1926	Plaster strip (cast)	Plaster strip (cast)	
Brackett <sup>5</sup>	1919	Recording the flexibility laterally		
Bradford <sup>5</sup>	1919	Advocated Dr. Brackett's method of following the curvature.		
Bradford <sup>5</sup>	1913	Flexibility	Special Apparatus	Scoliosometer
Bradford <sup>5</sup>	1907	Glass plate (designed by other worker) with special diopter.		Diopter
Truslow <sup>26</sup>	1914	Recommended a method of measuring the semicircumference in following these curves.		
Rucholz				
Osgood <sup>28</sup>	1914	Standardized photographs		Frame
O'Reilly <sup>27</sup>	1912	Standardized photographs		Frame
Young <sup>28</sup>	1912	T-square method		Special T-square
Beely <sup>29</sup>	1910	Rod-kyrtometer	Rod-kyrtometer	Rod-Kyrtometer
Stein <sup>30</sup>	1905	Photographs taken behind wire screen with camera and patient standardized.		Wire Screen
Feiss <sup>31</sup>	1905	Locate three standard points on contour of chest. Record in relation to pelvis.		
Freiberg <sup>32</sup>	1905	Etch on glass. Transfer to cross-section paper to scale.		Glass Plate with paper
Fitz <sup>33</sup>	1905	Mark on celluloid plate hung on patient.		Celluloid plate
Schulthess <sup>1</sup>	1905	Elaborate pantogram	Level, indicator <sup>36</sup>	Pantogram level indicator
Taylor <sup>34</sup>	1904		Yardstick method	
Mikulicz <sup>5</sup>	1904	Scoliosometer	Scoliosometer	Scoliosometer
Hovorka <sup>35</sup>	1904	Decimetric screen		Decimetric screen

an indication that none has been satisfactory. Attempts have been made to measure and record both the lateral and rotational components of the deformity. Special apparatus have been developed

to measure each component, but seldom both. They have varied in complexity from simple measuring devices, such as a band for measurement of circumference of the chest, to the elaborate and expensive devices designed by Schulthess<sup>1</sup> and Böhne.<sup>2</sup> Such prominent surgeons as Bradford<sup>3,5</sup> of Boston and Mikulicz<sup>6</sup> of Breslau, Poland, along with Schulthess, are among the hosts who have presented various methods for measuring and recording these curvatures. More than 60 methods have been proposed, and at least 50 of these have been accompanied by special apparatus, both simple and complex.

In 1911, Roland O. Meisenbach<sup>7</sup> presented a paper to the American Orthopedic Association in Cincinnati. This paper discussed a method of measuring and recording spinal curvatures. No other reference to this method has been found in a careful search of the literature. Meisenbach called his instrument a "scoliometer." Although the apparatus described in this study is similar to that of Meisenbach, there are several points of difference which we believe to be improvements.

The apparatus described in this study (figs. 1 and 2) consists of an 8-foot steel upright shaft mounted on a solid base. On this shaft is a collar to which is attached the recording device. There is a key in the collar to stabilize it at different levels. This collar is attached to a circular framework containing 36 adjustable metal rods pointing inward from the circumference of the circle. The patient is placed in a standing position in the center of the horizontal circle. The rods are then pushed in to conform to the contour of the thorax, the record being obtained from calibrations on the rods.

A method of stabilizing the position of the patient is essential. This is accomplished by a plumb line hung from a bar over the patient's head and is used to center the spine. Since the most prominent feature of scoliosis is its lateral deviation, it is, of course, impossible to center the plumb line over the entire spine. With this in mind it seemed a good idea to choose a reference point,

Table 3: Methods of Measuring Scoliosis Used Prior to 1900.

	Lateral	Special Apparatus
Young <sup>3*</sup>	Improved trolley delineator (improvement of the Weigel machine)	Improved trolley delineator
Barwell	Scoliosis gage	Scoliosis gage
Beely	Model bandage (pliable reproduction)	Model bandage
Blondotti	Thoracograph	Thoracograph
Bührings	Glass table	Glass table
Elkington	Rod-kyrtometer	Rod-kyrtometer
Elkington	Notograph	Notograph
Gramelski	Scoliosometer	Scoliosometer
Heineke	Scoliosometer	Scoliosometer
McLaren	McLaren's measurements	
Rausch	Tachygraph	Tachygraph
Roberts	Dianastropometry	
Roth	Tin strip (also rotational)	
Sargent	Sargent's charts	
Schenk	Thoracograph	Thoracograph
Schildback	Camera obscura	Camera obscura
Scudder	Scoliosometer	Scoliosometer
Soehn		
Burkart	Thoracograph	Thoracograph
Spillay	Make photograph of patient on paper with previously ruled lines.	
Virehow	Notograph	Notograph
Weigel	Tachygraph	Tachygraph
Weil	Apparatus	Apparatus
Zander	Scoliosometry	

\*See Young<sup>3\*</sup>; names and apparatus appeared in this article but no further information was given, therefore, except when obvious, it is not known which component of the curvature this apparatus was designed to measure.

Table 4: Methods of Measurements for Which the Originator Is Unknown

Date	Lateral	Rotational	Special Apparatus
1919*	Hst measuring device		
1907†	Dental wax method		
1900‡	Zinc strips	Zinc strips	
1900‡	Lead strips	Lead Strips	
1900‡	Cyrtometer (not Beely)		Cyrtometer
1900‡	Callipers		Callipers
1900‡	Spirit level		Spirit level
1900‡	Simple co-ordination		
1900‡	Measuring band (simple measurement)		

\*See Bradford<sup>3</sup>; †see Bergman<sup>4</sup>; ‡see Young<sup>3\*</sup>; method appeared in these articles but no further information was given; therefore, except when obvious, it is not known which component of the curvature this method measures.

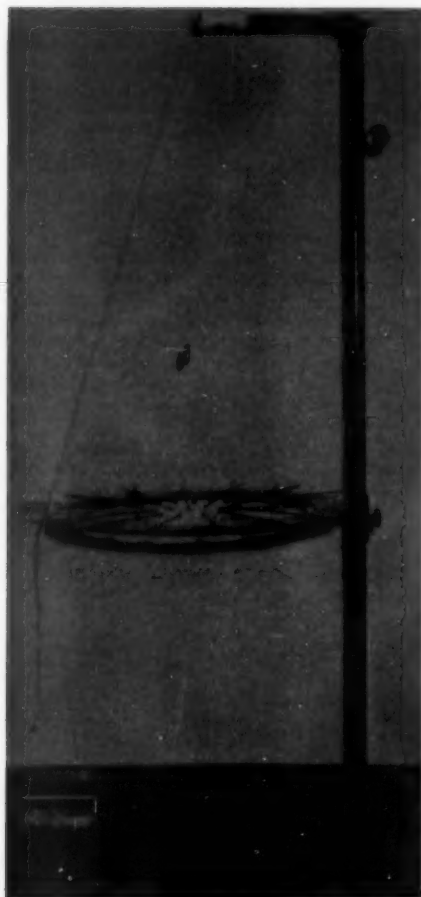


Fig. 1 — Scoliosimeter used in Orthopedic Division, Department of Surgery.

such as the spinous process of the seventh cervical vertebrae or the occipital protuberance, and align the patient from this point of reference. A head halter with a light traction, insufficient to alter the curve but enough to stabilize the patient, is also helpful in some cases.

The position of the feet on the platform is of significance when the head is kept in a uniform position. This is especially important in the severe and uncompensated cases. The position of the feet is recorded as a part of the permanent recordings. This is accomplished by having a permanent scale on the platform or by measuring the distance from the heels to the edge of the platform; the

lateral deviation is also recorded from a central reference line.

Recordings are taken at several different levels—sternal notch, fifth and tenth thoracic and first lumbar vertebrae, iliac crest, and greater trochanter of the femur—instead of at only one level as Meisenbach apparently did.

Meisenbach's apparatus has other differences. It has two collars, the lower having attached a pelvic triangle that serves to stabilize the position of the patient.

It has been our experience that pelvic stabilization is disadvantageous. The changes that occur in the pelvis in relation to the trunk are as much an actual part of the scoliosis curve as are the changes in the trunk itself. Any stabilizing influence would eliminate this portion of the whole picture. Meisenbach also used foot restraints which were attached to the platform to aid in standardizing the position of the patient.

Our recording is accomplished by having the metal rods, which point inward, calibrated. It is possible to accurately transfer the trunk contour curves, to scale, onto chart paper which has converging lines (figs. 3 and 4) corresponding to the adjustable metal rods on the machine. The point at which these lines come together on the paper corresponds to the point directly over which the plumb line is located. It is then possible to visualize on paper both the contour of the thorax and abdomen and the relation of each plane to a central axial point.

This method of following scoliosis has been under study for three years. It has been used in conjunction with photographs and x-rays. With this device, it is possible to obtain an accurate record of the three-dimensional changes which occur. This information has been of assistance in supplementing the usual records with inspection, x-rays, and photographs. We are not recommending that it should in any way replace them but should be used in conjunction with them. We have observed that progressive changes that have gone unnoticed by any other method, including x-ray, can be detected by this method.

The photographs accompanying this article (figs. 1 and 2) are of the original design of the machine. The number of bars on the recording device has now been increased from 15 to 36. Also, the method for measuring and recording the position of the feet is not demonstrated in these photographs.

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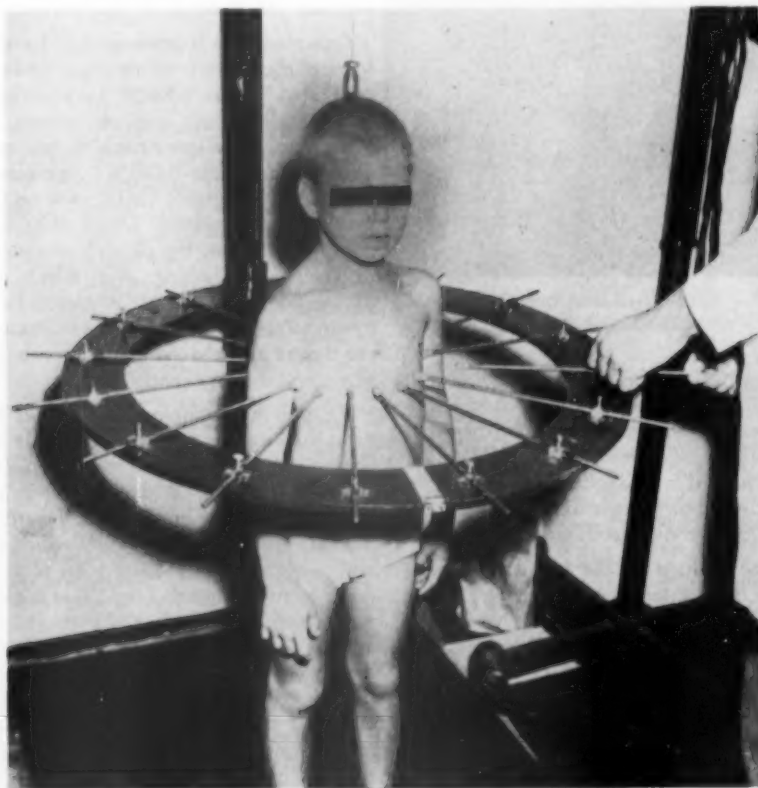
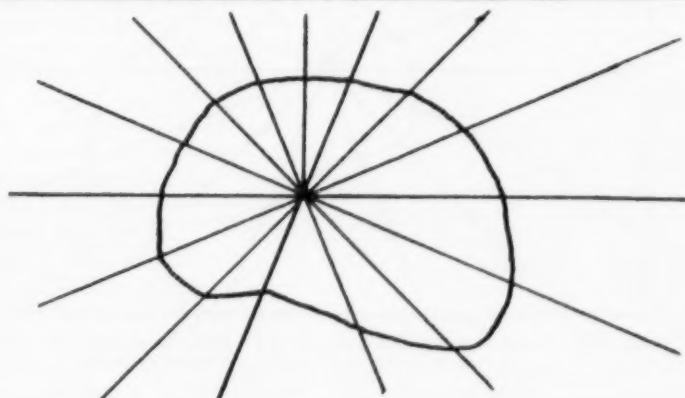


Fig. 2 — Scoliometer with patient positioned for measurements at the thoracic level.



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T10



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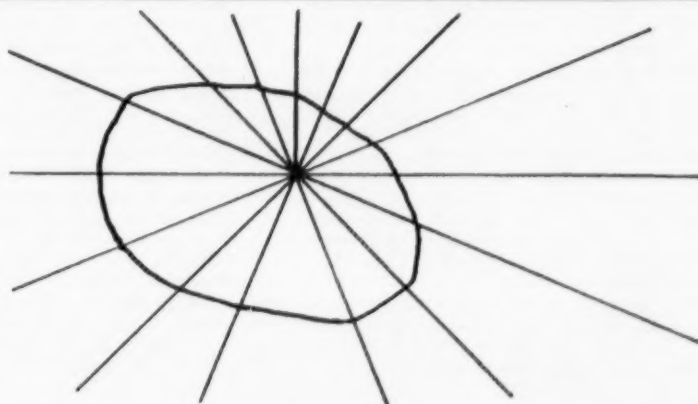


Fig. 3—Final tracings. Notice the chest contour here as compared with those taken at the same level five months later (fig. 4).

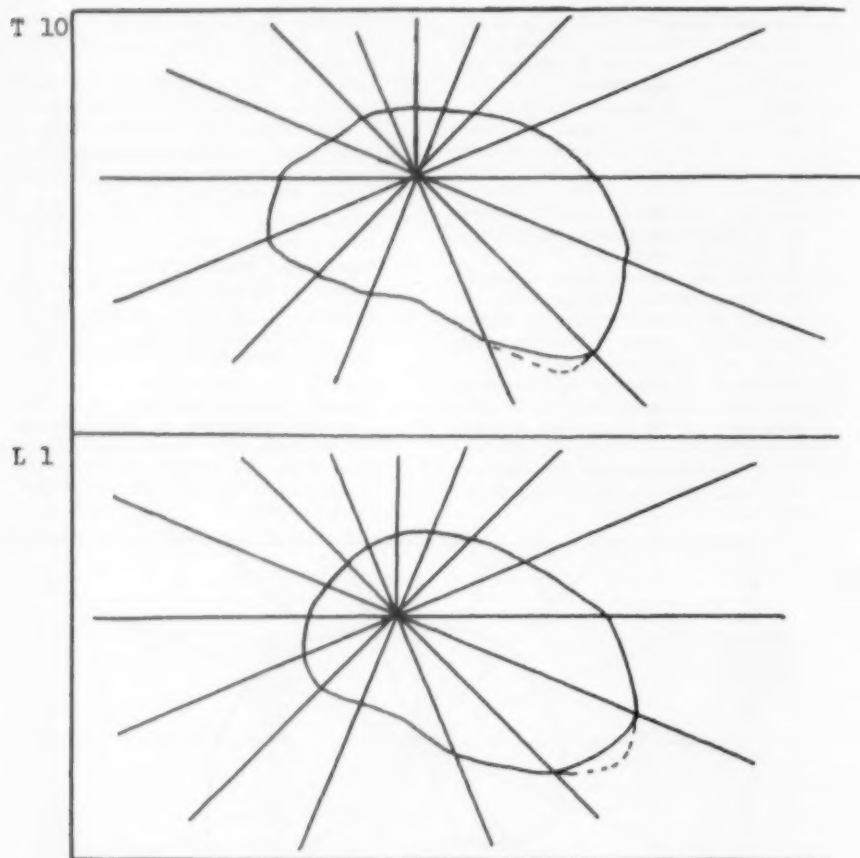


Fig. 4—Recording at tenth thoracic and first lumbar levels on the same patient as in figure 3. Notice the marked increase in deformity in this five-month period.

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# Respiratory Rehabilitation in Poliomyelitis

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## Pathology

While the pathology of poliomyelitis may be expressed in terms of a variable inflammatory and destructive lesion of lower motor nerve cells, the actual anatomical processes involved are extremely complex and far from thoroughly elucidated. The lesion in the nervous system has been shown to be widespread even in nonparalytic disease, and the clinical manifestations in any given infection seem to depend upon many factors, some of them unknown. In respiratory paralysis, the principal lesion is one of neuronolysis and neuronophagia in the motor cells of the cervicodorsal spinal cord. This lesion, however, is soon complicated by the effects of disuse, by alterations in the mobility of the costovertebral joints, and probably by changes within the elastic tissues of the lungs as well.

Patients with bulbar lesions, most of whom now survive, usually have a great potential for recovery. Among those with breathing problems, many need respiratory assistance for relatively short times unless there is associated high spinal cord disease. Nevertheless, during the acute stage of the illness, it is important to understand the pathological mechanisms of central respiratory paralysis and to deal with the important manifestations of dysrhythmia, cardiovascular abnormalities, excessive sialorrhea, and accompanying paralysis of deglutition or phonation if these occur. Rehabilitation of patients with the bulbar manifestations mentioned is also a major problem, but is beyond the scope of this discussion.

Because of variation in the site and extent of spinal cord lesions, there is a very broad spectrum of respiratory defects. For example, in one instance, all of the muscles of respiration may be

involved. In another, the diaphragm may be involved, wholly or on one side only. If the intercostals are preserved, there may be paradoxical motion of the diaphragm in inspiration. Conversely, an active diaphragm may produce paradoxical rib motion on inspiration. This is especially common in children. Prognosis is influenced by both location and extent of weakness in both primary and auxiliary muscles of respiration.

One of the important auxiliary muscle groups is comprised of the recti abdomini and the lateral abdominal muscles. In the erect posture an intact diaphragm cannot function adequately if the abdominal wall is flaccid. The diaphragm is an inspiratory muscle and adequate expiration is possible only if the elastic recoil of the lungs is not handicapped by a weak abdominal wall and sagging viscera. Even when the diaphragm is weak, the patient in the erect position who has strong anterior trunk muscles readily learns to supplement respiration by bringing the abdominal muscles into play to assist expiration. Inspiration may then be passively accomplished by relaxation of the abdominal wall. This permits the viscera to descend by gravity and pull the diaphragm down. Patients with weak or paralyzed diaphragms who retain good power in abdominal muscles, therefore, possess relative facility of breathing in the erect posture, but marked disability in the recumbent position.

In contrast, those with good diaphragmatic power and weak abdominals

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fare better in the recumbent position. These patients fatigue rapidly on sitting or standing and may show a vital capacity diminution by as much as 35 per cent by changing from horizontal to erect body position. The application of an abdominal belt or a corset and use of a pad positioned for maximal increase of vital capacity may mean the difference between useful function with tolerance of the standing position and invalidism in bed.

The degree of weakness of the sternocleidomastoid muscles and the anterior neck, shoulder, and posterior neck muscles is also significant in terms of recovery potential. However, the patient who is dependent upon these accessories cannot become entirely independent of respiratory aids.

The importance of careful analysis of the nature of the neuromuscular lesion in respiratory paralysis cannot be too much emphasized. Not only the rationale of treatment but also the ultimate planning for activity depends upon thorough knowledge of the respiratory pattern and accurate appraisal of functional capacity. On the basis of clinical observations, respirometric data obtained from patients in recumbent, sitting, and erect positions, and tests with supportive devices, it is possible to prescribe rehabilitation procedures with considerable precision.

#### Early Care

Aside from the motor aspect of ventilation, an important consideration from the very onset of paralytic disease is the character and function of the airway. When the disease is primarily medullary, mechanical difficulties may arise from muscular paralysis leading to relaxation of pharyngeal structures or weakness of the glottis. This is almost invariably accompanied by accumulation of secretions that cannot be expectorated or swallowed. Gradual development of hypoxia stimulates greater outpouring of secretions. This chain of events, with resultant fatigue and intermittent or persistent hypoxia, almost certainly increases the vulnerability of nerve cells and leads to greater viral invasion. The importance

of the assurance of an adequate airway and prevention of even transient hypoxia seems to be demonstrated, at least by inference, by the reduced rates of fatality and the extent of paralysis which have been achieved in treatment centers where tracheostomy is performed early and respiratory assistance is provided before there are critical signs of respiratory insufficiency.

It is difficult to estimate the relative importance of various elements of care in determining prognosis. In addition to maintenance of an adequate airway and prevention of even transient hypoxia by early use of the respirator, avoidance of unnecessary psychological stress, prevention of fatigue, and preservation of nutrition are also significant. Nevertheless, patency of the airway is obviously a primary factor since it makes possible adequate ventilation by natural or artificial means. Therefore, since the provision of a supplementary airway through tracheostomy assumes critical importance, the indications for this procedure must be thoroughly understood and observed. In general, the occurrence of high fever, rapidly progressive weakening of muscle groups (particularly those about the shoulder), rapid fall of vital capacity, and signs of pharyngeal and laryngeal paralysis with accumulation of secretions constitute the major indications for tracheostomy. In addition, it should be emphasized that the use of the bronchoscope during the acute phase of poliomyelitis also requires tracheostomy while the scope is in situ since rapid obstruction from laryngeal edema may follow its withdrawal.

#### Use of the Respirator

Another major consideration in treatment as it affects rehabilitation potential is the skillful timing of the use of the respirator. Experience in the observation and care of patients with acute poliomyelitis leads to increasing reliance upon clinical impressions as well as mechanical measurements. There can be no question, however, of the validity of the measured vital capacity as an indicator of respiratory status. Both the rate of fall and the degree of diminution of

vital capacity are significant. When the vital capacity falls to 50 per cent of the predicted normal, many patients show signs of fatigue and require respiratory assistance, not necessarily for survival, but for maximum recovery potential. When the vital capacity falls to 30 or 35 per cent of predicted normal, the indications for respiratory assistance become absolute. Decision to use the respirator when the vital capacity ranges between 30 and 50 per cent of predicted normal is influenced by observed difficulty in breathing, increasing pulse rate, rise or fall of blood pressure, increasing rate of respiration, subjective manifestations of fatigue, and, especially changes in the state of consciousness.

Many patients react with dread to the diagnosis of poliomyelitis and with added fear when confronted with a respirator. Failure to explain the reasons for and the general procedures of every detail of management and to encourage patient acceptance constitutes a serious defect in care. Furthermore, the way in which the patient is brought through the critical phase from first awareness of breathing difficulty to respiratory comfort in the mechanical respirator is of extreme importance. Assured skill on the part of a well-trained and integrated medical and nursing team contributes greatly to the smoothness of the patient's convalescence, while a frantic, disorganized, bungling effort by inadequately trained personnel may complicate the illness and convalescence and always lengthens the rehabilitation period.

#### Respirator Phase of Care

Once the patient is placed in the respirator it is essential to supply enough ventilatory assistance to assure oxygen supply and avoid hypercapnia but not so much as to produce respiratory alkalosis through hypocapnia. It is also mandatory that fluid intake and electrolyte balance be carefully maintained and that a program be instituted at once to prevent disuse atrophy and other decubitus phenomena. In many instances an indwelling catheter must be placed in the bladder and usually fluid is at first given intravenously. Gastric distention is

relieved by nasogastric intubation, and later the patient may be fed a suitable diet via the tube.

The respirator patient can now be maintained in remarkable homeostasis. The use of predicted tidal air values provided by Radford's nomogram<sup>1</sup> and modification of respirator pressures on the basis of rapid analysis of alveolar carbon dioxide concentration<sup>2</sup> make it possible to avoid both hypoventilation with acidosis and hyperventilation with respiratory alkalosis in some convalescent respirator patients. In some instances it may also be necessary to determine arterial oxygen saturation and arterial blood pH; and knowledge of electrolyte concentration (serum sodium and potassium, carbon dioxide content, etc.) is helpful, especially in the first few days of critical illness.

The rehabilitation of the respiratory paralytic, as has already been emphasized, is greatly influenced by early care. Problems of motivation and participation arise principally in patients whose acute phase has been difficult and whose clinical course has been stormy. Resistance to and harmful delay in activity and therapy programs often result from psychological and decubitus phenomena, all of which can be prevented.

During the acute febrile phase, as in the case of paralytic patients with good respiratory function, activity is limited to frequent change of position and passive motion of the extremities throughout maximum range at least once and preferably twice daily. When fever has thoroughly subsided, and this implies two or three completely afebrile days, the program of activity is increased. As soon as possible, active motion is encouraged and passive motion is increased to careful stretching in order to re-establish full range where tightness is already present. Hot blanket packs, the Hubbard tank, and analgesic medications are prescribed as needed in each case. Throughout this period, as in all phases of rehabilitation, the general exercise program is closely integrated with the respiratory program and careful consideration is given to the prescription of exercises that do not exceed the respiratory capacity of the patient.

### Withdrawal of the Respirator

The detailed program of the respiratory phase of convalescence and rehabilitation is determined largely by the degree of paralysis and the location of the lesion. The respiratory prognosis can be roughly plotted from changes in the vital capacity during the first few weeks of illness as was originally shown by Bower and co-workers.<sup>3</sup> The character of the recovery curve is a critical basis for prescribing the daily program. No premium is placed upon success in "weaning" the patient from a respiratory device without which he cannot adequately breathe. In planning the rate and manner of withdrawal of the respirator, therefore, it is necessary to have up-to-date respiratory function data and a clear analysis of the breathing pattern which includes repeated evaluation of the residual power of the diaphragm, the intercostals, and the abdominal and accessory respiratory muscles.

When, during the acute illness, the vital capacity falls only to approximately one-fourth the predicted value, it may be possible during convalescence to make a fairly rapid transition directly from the tank respirator to lesser aids, such as the rocking bed or the chest cuirass respirator. In the more severely paralyzed, particularly those in whom the vital capacity falls to 100 cc. or below, the patient must be prepared psychologically to accept each transfer to lesser aids. Transfer should be accomplished during continued artificial respiration by a positive pressure device, at least until adjustment is made to the lesser aid. The apparatus of choice, and the one which the severely paralyzed patient usually best accepts, is a combined rocking bed and cuirass respirator in which both modalities of respiratory assistance are synchronized. When there has been good adjustment to this device for increasing periods daily, the assistive devices may be tried separately. Eventually most patients succeed in adjusting to both the rocking bed and the cuirass respirator.

### The Rehabilitation Program

The tempo of the rehabilitation program is in large part determined by the rate at which respiratory power returns.

The details of the program, however, are greatly influenced by the nature and degree of involvement of peripheral muscles. A complete appraisal is made on the basis of respiratory data, the muscle test, and observation of functional use of the extremities and trunk. A specific program of physical and occupational therapy is then prescribed with emphasis on strengthening and improvement of co-ordination of muscles about the shoulder, upper trunk, and abdomen, insofar as respiration is concerned, and in the muscles of the extremities, insofar as ambulation and upper extremity functions may be achieved. In addition, all the adjuncts of care that may be required are brought into the program. This includes speech therapy when necessary, individual and group psychotherapy, recreational programs, and social case work, as well as preliminary vocational study and counseling in adults and resumption of schooling in children.

The amount of time for each phase of therapy and the location where exercises and other treatments are carried out is determined in relation to respiratory capacity. Thus, the patient may be moved to a Hubbard tank for exercise but during this treatment may need continuous respiratory assistance by means of a positive pressure breathing device. Similarly, the patient may benefit from a mat program, but this may not be carried out safely without respiratory assistance. In order to prevent fatigue, the mat exercises may be carried out with the aid of a positive pressure respirator or rest periods with respiratory assistance may be interposed between exercise periods. Thus the respiratory program is always carefully integrated with the general rehabilitation program and fatigue and anxiety are meticulously avoided.

During and even after the period of recovery, trunk support may be required to prevent postural deformities. A corset is supplied before the patient with weak trunk muscles is permitted to sit in a wheelchair. Whether or not trunk support is needed, it may be essential to provide a corset with an abdominal pad in order to overcome the handicap of abdominal paralysis in relation to respiration.



During the course of the rehabilitation program, specific exercise procedures may be applied to respiratory muscles. The effectiveness of these methods is extremely difficult to evaluate and scientific proof is largely wanting in respect to most of them. However, there seems to be good rationale for manipulative methods which tend to maintain mobility of the costovertebral joints and for exercise methods which introduce resistance to functioning muscles. In the first category, diagonal manual manipulation and compression of the thorax seem to diminish tightness and to help maintain flexibility of the chest. Manual resistive exercises applied to the upper abdomen during inspiration and to the lower chest during intercostal inspiratory effort are at least theoretically useful. Other measures that contribute to flexibility of the chest are passive elevation and stretch of the upper extremities, which produce tension in the pectoral muscles and elevate the ribs much as in the Silvester maneuver for artificial respiration. Exercises should also be carried out in the prone position when possible, utilizing whatever type of push-up is possible to strengthen the shoulder muscles and increase the range of extension of the upper spine. Thigh flexion and trunk flexion exercises to strengthen the abdominal muscles also have obvious merit, if they can be carried out. In each instance the therapy prescription is modified according to the degree of functional recovery and the changing respiratory status.

#### Pulmonary Thoracic Compliance

Much consideration has been given during the past few years to the question of pulmonary thoracic compliance. This may be defined as the volume change per unit of pressure change; in practice, the change in the volume of respiratory air flow in proportion to the pressure change within the thorax (or pressure applied to the thorax as it is in the tank respirator). Compliance is important in relation to the efficiency of respiratory muscles, and the advantage of a relatively pliable thorax and lungs is obvious. Many of the manipulative methods of

therapy are intended to improve compliance. Deep-breathing devices used independently or attached to respirators are presumed to serve the same purpose. Accurate evaluation of the efficacy of these measures is difficult and no conclusive studies have yet been made which provide a good basis for evaluation. On clinical grounds, however, there seems to be merit in all these measures. In addition, a most effective means of maintaining compliance seems to be the utilization of a nonmechanical method, namely, glossopharyngeal breathing performed by the patient himself.

#### Glossopharyngeal Breathing

Glossopharyngeal breathing, initially described by Dail<sup>4</sup> after he had observed its spontaneous use by a patient, has now become an important therapeutic adjunct in all respiratory treatment centers. The technic has been adequately described and need not be presented here except in brief outline. It consists of using the tongue and mouth as a pump to force air through the open glottis into the lungs by means of a series of gulp-like maneuvers. This is followed by passive expiration. Most patients who have more than 150 cc. vital capacity and who do not have severe pharyngeal paralysis can learn this technic. Some can achieve inspiratory filling that equals or exceeds their predicted vital capacity. The exercise of maximum inspiration by glossopharyngeal breathing seems to help maintain compliance of the lungs and thorax according to the opinion of many observers. In addition to its value in this respect, glossopharyngeal breathing augments cough and provides an auxiliary means of respiration which is not only useful in ordinary activity but life-saving under emergency circumstances. In some instances, a subthreshold tidal air may be adequately supplemented by one or two glossopharyngeal gulps after each breath to permit the patient to carry on a fairly active daily program even though he may need respiratory assistance during sleep.

#### Therapeutic Goal

In the course of recovery and on the basis of repeated evaluation of respiratory

function, muscle strength, psychological adjustment, and vocational potentiality, the rehabilitation program is carefully and realistically designed and modified as progress is made toward recovery. Before good functional tests were available, the therapeutic goal seemed invariably to be maximum freedom from respiratory assistance. As a consequence, many respiratory paralytics were literally forced out of respirators and permitted slowly to become asphyxiated. The development of reliable respirometric tests, of the cuirass respirator, of positive pressure respirators, and of the rocking bed have now made it possible to provide the respiratory paralytic with almost precisely the amount of respiratory assistance necessary under the varying circumstances of his life activity. It has gradually become clear that maintenance of adequate respiration is essential in the face of chronic respiratory disability just as it is during the acute phase of poliomyelitis. When an attempt is made to force "weaning," the consequences may be slow in development but ultimately prove seriously damaging to the patient. The tidal air flow may seem to be adequate, the alveolar carbon dioxide tension may not be unusually high, and homeostasis may generally appear to be maintained. Yet the patient who drives himself, with or without medical persuasion, to eliminate respiratory aids when such action is not justified, may gradually develop some or all of a constellation of symptoms which have been recognized as typical of chronic respiratory insufficiency and the accompanying phenomena due to stress. Characteristic symptoms are increasing tightness of the soft tissues of the extremities with a tendency toward fixation of joints, gradually increasing hypertension, acne or seborrhea, "moon face," irritability, disinterest, depression, lability of mood with frequent crying, and cutaneous or deep hyperalgesia. The metabolic components are hypercalcemia, hypercalcuria, hyposthenuria, inanition, and, ultimately, renal or cardiac failure.<sup>6</sup> In some patients, chronic pulmonary hypertension can also be demonstrated by cardiac catheterization.<sup>7</sup>

Interestingly enough, this hypoxic, com-

plex syndrome can be reversed in most instances by reinstitution of maximum respiratory assistance, graduated physical therapy, skillful psychotherapy, and extremely careful nursing attention. Many weeks may pass before an active program can be instituted. At this point, gradual and realistic withdrawal of aids is begun and the patient is then established on a program of respiratory assistance designed to prevent fatigue and a repetition of the damaging stressful situation resulting from inadequate ventilation. The course of events in patients whose poorly managed convalescence is corrected by sound rehabilitation methods serves to emphasize the importance of the type of carefully designed program which has been described.

#### Summary

The pathology of respiratory paralysis due to poliomyelitis and the resulting physiological manifestations are complex, requiring careful clinical evaluation in respect to rehabilitation potential. Early-phase care, with special reference to adequacy of airway and pulmonary ventilation for prevention of even transient hypoxia, has a strong influence on prognosis, including both rate of progress and extent of rehabilitation. Gradual diminution of respiratory assistance through use of mechanical devices other than the body (tank type) respirator permits integration of a total rehabilitation program. The general exercise program and the respiratory program are so interrelated as to avoid fatigue and yet permit maximum activity. A variety of respiratory assistive devices and the nonmechanical method of glossopharyngeal breathing aid in the rehabilitation process. Excessive withdrawal of respiratory assistance leads to major metabolic disorder and defeats the rehabilitation program. The realistic goal of rehabilitation is maximum feasible activity within the limits of respiratory function.

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#### Discussion

*Nadene Coyne (Cleveland):* Dr. Lewis has thoroughly outlined the many important factors that must be carefully considered and diligently watched to insure the poliomyelitis patient with respiratory involvement the retention of that functional potential left by the virus.

It is obvious that respiratory rehabilitation cannot be separated from total physical rehabilitation and that any functional progression for the patient must be based on the respiratory status.

The changing emphasis from a goal of freedom from respiratory aid to safe

maximal function has emancipated many a respiratory cripple and complicated the convalescent care.

Criteria are fairly well established, though not fool-proof, for good care of the patient in the acute stage and maintenance of homeostasis.

The postacute care involves more intangible factors. Fatigue, anxiety, and endurance are vitally important but are words without even exact definition. The ill effects of anxiety and fatigue are known. Prevention is based on clinical judgment. The energy cost of any one activity varies with each patient.

There are two points which I feel Dr. Lewis has not emphasized. One, the necessity of understanding and co-operation of all persons working directly with the patient. The thoughtless urging by a volunteer worker that a patient try harder when he is working at maximum or the neglect of a session of positive pressure because this is the day the patient is to have a tub bath point out the importance of indoctrination of all personnel. Thus, the respirator patient remains a patient even after discharge. Average re-admission rate in centers for the patients is at least once per year. Even perfect care during hospitalization does not insure the patient continued security in the home unless the people caring for him there understand the use and care of the equipment, reasons for limitations of activity, careful diet, care of early respiratory infections, prevention of deformity, and psychological importance to the patient of independent activity.

# Physical Fitness Index Studies (PFI) in Hospitalized Diabetic Patients

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## Introduction

In a preliminary study,<sup>1</sup> 30 diabetic patients hospitalized at Crile VA Hospital were examined as to their physical fitness index (PFI) before and after an activity program including exercise in corrective therapy and assignment to manual arts therapy. It was shown that the average PFI was raised after such a program by about 20 per cent in the patients studied. The present report deals with the study of 19 additional patients, of whom 9 had corrective therapy and 10 had either no assignment to physical medicine rehabilitation, or else assignment to activity in occupational therapy, manual arts therapy, or both.

## Method of Study

As in the previous report, the Rogers' physical fitness test was used and the results compared with the norms established by this author.<sup>2</sup> The following items are required for the evaluation of the Rogers' PFI: age, height, weight, lung capacity (in cubic inches with a wet spirometer), grip strength as measured by a manometer (right and left hands), back lift, leg lift, number of pull ups, and number of push ups.

The ASI (achieved strength index) equals the sum of the following: lung capacity in cubic inches, grip strength (right and left), back lift, leg lift, and arm strength. The arm strength is obtained by adding the pull ups and push ups, multiplying this sum by the weight of the patient divided by 10, plus the height minus 60. This is then compared with the NSI (normal strength index) obtained by Rogers from examination of normal individuals.

The PFI is obtained by dividing the ASI by the NSI and multiplying by 100.

On referral to the physical medicine and rehabilitation service each diabetic patient was examined on the first day, and his PFI obtained. The patients were then assigned in rotation to corrective therapy alone or to some other activity with or without corrective therapy.

In corrective therapy the patients were given 15 minutes of exercise twice daily, including: wall pulleys, bicycle, rowing machine, and medicine ball. It will be noted that the exercises did not include any of those used in the PFI studies so that the factor of improvement through learning could be obviated.

Patients referred to manual arts therapy were assigned to progressively increasing activity in one or more of the following areas: woodwork, metal work, plastics, photography, and electronics.

In occupational therapy they had a choice of leather work, ceramics, weaving, stenciling, printing, painting, and sewing.

## Results

All patients were given a routine diabetic diet and insulin consistent with their needs. Seven patients (table 1) were referred to corrective therapy for exercise twice daily. They were not referred to manual arts therapy or to occupational therapy but were permitted to participate in the usual hospital routine. The PFI on admission varied between 17

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Table 1: Patients Exercised in Corrective Therapy

Patient	Initial Score	Final Score	Change	Days Treatment
1	30	66	+36	30
2	69	60	0	18
3	40	50	+10	14
4	17	22	+ 5	26
5	65	81	+16	10
6	37	41	+ 4	5
7	49	66	+17	25
*8	41	44	+ 3	17
*9	33	49	+16	50
Average	41.2	53.2	+12 (29%)	22

\*Patients 8 and 9 were also assigned to Occupational Therapy

Table 2: Patients Not Exercised in Corrective Therapy

Assignment	Initial Score	Final Score	Change	Days Treatment
*OT	40	44	+ 4	25
OT	64	67	+ 3	9
OT	90	73	-17	14
**MAT	50	51	+ 1	10
MAT	58	50	- 8	20
MAT	74	62	-12	14
MAT and OT	29	28	- 1	60
None	50	40	-10	7
None	43	53	+10	48
None	36	46	+10	37
Average	53.4	51.4	- 2 (-3.7%)	24.4

\*OT -- Occupational Therapy

\*\*MAT -- Manual Arts Therapy

and 65, with an average of 42. The PFI before discharge ranged from 22 to 81, with an average of 55. The number of days of treatment ranged from 5 to 30, with a mean of 23 days. Six of the seven patients showed an increase varying from 4 to 33. One patient showed no change. The average increase in PFI of the seven patients tested was 12.5.

Two additional patients were referred to corrective therapy for exercise, and for activity in occupational therapy. Their initial PFI's were 41 and 33; their final PFI's were 44 and 49. The number of days of treatment was 17 and 50 respectively. Both showed an increase in the PFI index, the first of 3 and the second of 16.

Combining the results obtained among these nine patients who were given regu-

lar exercise, there was an increase of the PFI of an average of 12, or 28.5 per cent. Figure 1 graphically illustrates the results obtained by exercise in corrective therapy.

Ten control patients were not referred to corrective therapy for a supervised exercise program. Of these, three were referred to manual arts therapy for gradually increasing activity, one to manual arts therapy and occupational therapy, three to occupational therapy, and three had no organized activity except that assigned to them on the ward. Table 2 shows the results in each of these categories. Among these ten, the PFI on admission ranged from 29 to 90, with an average of 53. The final PFI varied between 28 and 73 with an average of 51. The duration of treatment was 9 to 60

days. The average PFI change was  $-2$ , or  $-3.7$  per cent. Figure 2 graphically illustrates the change in PFI in these patients.

Since the patients referred to us are industrially employed veterans rather than college students, it was deemed advisable to check the PFI of employed healthy individuals of comparable age. For this purpose ten therapists from corrective therapy, physical therapy, and manual arts therapy (all males) were given PFI testing. Their PFI range was from 42 to 93, with average of 63.3. All of these men were engaged in daily activity of a highly physical nature. When compared with this figure of 63.3, the PFI of exercised diabetic patients, namely 52, is not as far out of line as it would be if compared to the norm PFI of 100.

#### Comment

In the previous preliminary study already referred to, 30 patients showed an average increase of 19 per cent in their PFI after a course of corrective therapy and manual arts training. In the present

study, 19 patients were separated into two general groups, those who received supervised exercise in corrective therapy, and those who did not. Of the nine patients who received regular exercise in corrective therapy all but one showed an increase in the PFI, the average for the nine patients being 12, or 29 per cent. Of the ten patients who did not receive regular exercise in corrective therapy, only two showed a substantial increase in their PFI's and eight showed either no increase or a reduction after variable periods of hospitalization, the average variation being  $-2$ , or  $-3.7$  per cent.

#### Summary and Conclusions

Nineteen diabetic patients (in addition to 30 previously reported) were studied as regards the effect on their physical fitness index (PFI) of supervised exercise. Nine patients receiving exercise showed an average increase in their PFI of 12, or 29 per cent. Ten patients not receiving regular supervised exercise showed an average decrease in their PFI of  $-2$  or  $-3.7$  per cent. Diabetic patients under proper diet and insulin can increase their PFI by an organized program of exercise.

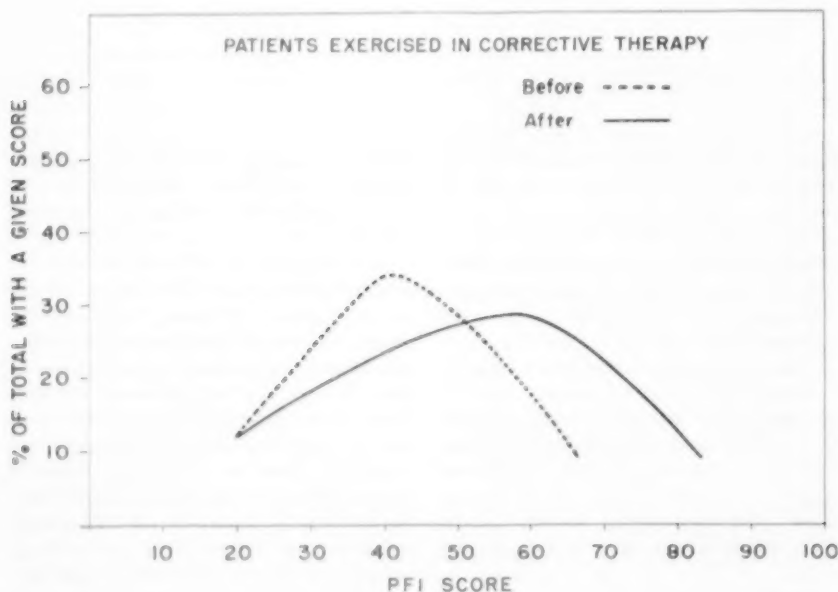


Fig. 1



## References

1. Zankel, H. T.; Raymer, E.; Ullman, M., and Chiorian, E.: Physical Fitness Index Studies in Hospitalized Diabetic Patients, a Preliminary Report. *J. Phys. & Ment. Rehab.* 10:14 (Jan.-Feb.) 1956.
2. Rogers, F. R., cited by Clarke, H. H.: Application of Measurement to Health and Physical Education, ed. 2, New York, Prentice-Hall, Inc., 1950.

## Discussion

*George Morris Pietsol (Philadelphia):* Guided by the work of many physiologists, during the past 20 years clinicians have taken an increasing interest in the problems of physical fitness and fatigue. The observations of Keys, Dock and many others, made over a decade ago, on the ill effects of prolonged bed rest sharply focused the attention of the medical profession generally on the importance of applying established physiological principles to patient management. The widespread adoption of this concept has revolutionized the care of the convalescent, the chronically sick, and disabled. To the large number of studies that have been carried out on the role of regulated and appropriate exercise in

maintaining physical fitness in those suffering from chronic disease, Dr. Zankel and his associates have added an interesting contribution.

They selected for their investigations individuals suffering from such a commonly met disorder as diabetes. They were fortunate in having available patients who were well controlled and hospitalized. They are to be commended on the painstaking manner in which they have carried out the somewhat laborious but generally recognized Rogers' physical fitness test not only on diabetics but also on control groups. They have avoided the all too common error of drawing conclusions from impressions. Their results are based upon objective data. They have presented a useful method of quantitatively measuring the effects of several physical procedures upon such an important group of patients as the diabetics. They have produced some experimental evidence to support what has long been known clinically, that is, as Joslin has put it, "to the diabetic exercise is not a luxury it is a necessity."

They have found that hospitalized diabetics, well controlled by suitable diets

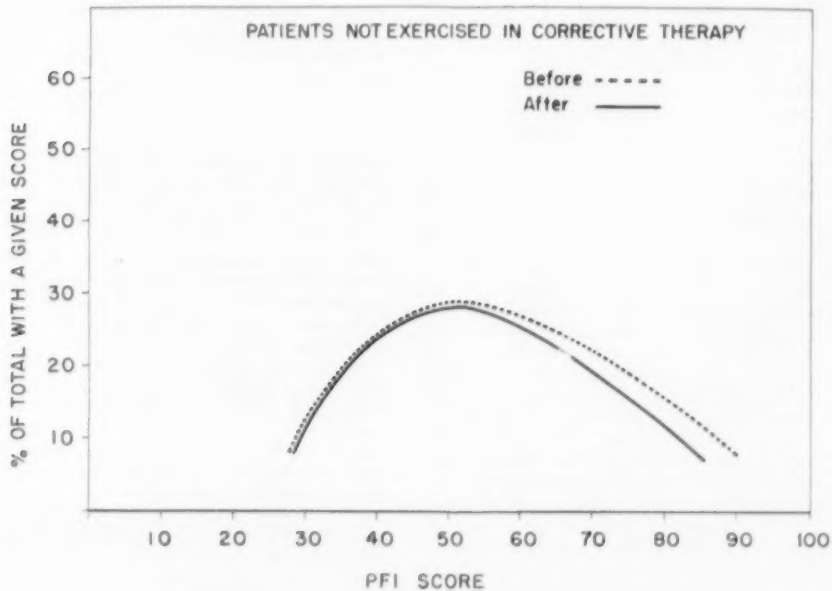


Fig. 2

and insulin, when placed upon a regimen of supervised active exercise for an average of three weeks showed significant improvement in their physical fitness index. This result might have been predicted since active exercise, when adapted to the diabetic patients' tolerance, causes muscles to burn up carbohydrate thereby lowering the blood sugar. Therefore, the patient can take more food and the demand for insulin is lowered. Since exercise is needed for the proper assimilation of carbohydrate, a diabetic requires exercises to do well. Even bed patients should carry out suitably selected bed gymnastics. In passing, it should be noted that overexercise may cause such a fall in blood sugar that symptoms of hypoglycemia or hyperinsulinism may appear. Therefore, the exercising diabetic should be carefully watched and such reactions avoided by lowering insulin or increasing carbohydrate intake.

It will be interesting to know whether the authors observed in their series, as the results of exercise, any need to decrease the dose of insulin and any in-

crease in carbohydrate tolerance. Mild regular active exercise does more than influence the metabolic deficiency of the diabetic—it brings about the beneficial general effects of exercise and aids in improving the circulation (especially in the legs) so often deficient in diabetics.

Dr. Zankel's investigation further emphasizes another well-known physiological principle, that is that increased muscle strength (an important factor in improving physical fitness) depends upon active voluntary muscular effort, particularly when systematically carried out. The control group of diabetics who were not referred to corrective therapy for a supervised active exercise program but received only varying amounts of manual arts or occupational therapy showed an average decrease in their PFI of  $-2$  to  $-3.7$  per cent, as compared to an equal number on active exercise where PFI increased from 12 to 29 per cent.

The careful observations of the authors of this paper lend added weight to the belief that "no care of diabetics should be considered too far advanced for an attempt at muscular redevelopment."

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## physical medicine abstracts

**E. E. G., Consciousness and Sleep.** Charles W. Simon, and William H. Emmons. *Science* 124:1066 (Nov. 30) 1956.

The authors studied 21 normal adult males with average or better I.Q. who showed continuous alpha pattern in a monopolar occipital E.E.G. while awake, resting, with eyes closed. A series of factual questions with answers was played one at a time at five minute intervals during eight hours of normal sleep while monopolar right occiput and vertex E.E.G. leads were continuously recorded. They correlated the quantity and quality of alpha, transitional and delta waves with variations of consciousness as measured by immediate response and later recall. When delta patterns were predominant, there was neither response nor recall. When transitional patterns were predominant, both response and recall were poor. With gradual increase in preponderance of normal alpha patterns, there was a gradual increase in response and recall.

The authors conclude that there is a systematic change of the E.E.G. from the full waking to the full sleeping state; since alpha rhythms are related to waking states, delta rhythms to sleeping states, the demonstration that response and recall occur only in the presence of alpha patterns negates the popular idea of learning while asleep; in addition to the classical measure of sleep (duration), an additional dimension (depth) is now available for studies of sleep.

**The Mechanics of Breathing in Different Body Positions. I. In Normal Subjects.** E. O. Attinger; R. G. Monroe, and M. S. Segal. *J. Clin. Invest.* 35:904 (Aug.) 1956.

The mechanics of breathing in several body positions in eight normal subjects were studied. Compliance (liters per cm. H<sub>2</sub>O) was defined as volume change brought about by one centimeter of water pressure while mechanical resistance (cm. H<sub>2</sub>O per liter per second) measures the amount of pressure necessary to obtain a certain flow rate. Intracosophageal pressures were substituted for intrapleural pressures.

Compliance and mechanical resistance were measured during slow and rapid breathing in the supine, prone, and sitting positions. Compliance was lowest in the supine and highest in the sitting position and did not alter with change in the respiratory rate.

Mechanical resistance was usually highest in the supine and lowest in the sitting posi-

tion. The authors felt that the amount and distribution of blood within the lungs was of the greatest significance in determining compliance and mechanical resistance in the various positions.

**Limiting Factors in Experimental Pain.** H. K. Beecher. *J. Chron. Dis.* 4:11 (July) 1956.

This article provides an excellent review of the problems which are encountered and the limiting factors which are present in attempting to evaluate experimental pain in both man and animals.

The studies of many reliable investigators indicate that the experimental pain threshold is neither constant from man to man, nor is it constant in a given individual from time to time. This is probably due to the extremely complex nature of the pain process and the fact that experience and conditioning enter into the experimental determination of the threshold.

It would seem that the basic difference in the evaluation of experimental pain in man and animal rests in the means of interpretation. The pain threshold in man represents a value judgment of the cortex, whereas pain threshold in the animal is in almost all cases a reflex reaction to presumed pain.

The author feels that the study of experimental pain has wide usefulness in both man and animals but that it is often misused, especially in man.

**Adaptations of Neuromuscular Facilitation Technics.** M. J. Torp. *Phys. Therapy Rev.* 36:377 (Sept.) 1956.

A lucid discussion is given of the foundation of facilitation. This includes maximal activation, resistance, basic reinforcements and advanced and integrated technics. Basic reinforcements described are proprioceptive mechanisms, working from the most favorable part of the active range, utilization of synergist innervation, priming with a secondary function of a muscle group, utilization of the most favorable position, and symmetrical motion of the opposite side. General utilization of facilitation technics is clearly presented. The cases cited as specific examples of use of these technics evoke questions in the reader's mind as to the reasons for using these technics on lower motor neuron lesions and functional paralyses.

**Posterior Inferior Cerebellar Artery Syndrome of Wallenberg After Chiropractic Manipulation.** G. A. Schwarz, et al. A.M.A. Arch. Int. Med. 97:352 (Sept.) 1956.

The authors present in detail, a case of a twenty-eight year old woman who had a thrombosed posterior inferior cerebellar artery following a manipulation of the neck by a chiropractor for a head cold. The authors reviewed the literature and noted reports that similar manipulations have resulted in basilar artery thrombosis, insufficiency of right posterior inferior cerebellar artery, dislocation of atlas on axis, and other neurologic calamities.

Anatomic and physiologic factors were reviewed. They point out that while stretching, tearing or compression of the parenchyma directly will explain damage to the spinal cord or spinal roots following chiropractic manipulation; the brain stem and cerebellum cannot

be so involved. These lesions are believed to be due to interference with the blood supply of the structures. Review of studies by Kunkle, et al, indicate that the vertebral arteries are particularly vulnerable to injury in spite of the fact that these vessels are of necessity very flexible in order to meet the wide mobility of the associated joints. The posterior inferior cerebellar artery is readily compressible where a portion of it lies close to the posterior rim of the foramen magnum, making it liable to trauma.

Although the leading cause of Wallenberg's syndrome is hypertension and/or arteriosclerosis, in young patients clinicians must think of trauma as being an etiologic agent. The authors stress prompt use of anticoagulants in such brain stem syndromes following manipulation or trauma.

## book reviews

*The reviews here published have been prepared by competent authorities and do not necessarily represent the opinions of the American Congress of Physical Medicine and Rehabilitation and/or the American Academy of Physical Medicine and Rehabilitation.*

**DOCTORS' OFFICES AND CLINICS:** Medical and Dental. By Paul Hayden Kirk and Eugene D. Sternberg. Cloth. Price \$12.00. Pp. 218, with illustrations. Reinhold Publishing Corp., 430 Park Ave., New York 22, 1955.

Here is a publication for the medical and dental practitioner that will, without a doubt, inform him of the business end of his profession concerning his place of practice.

Today's trend has introduced the clinical building, where groups of physicians safeguard the health of an entire neighborhood or community. Before a group can be formed, each individual making up this unit must answer the questions that face him: Shall I rent, remodel, or build? All these answers are in this volume. Cost tables are shown; sizes of lots are covered with numerous layouts of structures; maintenance and operation are outlined.

The authors are two competent architects experienced in the field. Through their efforts this 218 page volume is filled with photographs and descriptions of offices already built, showing their design and materials used. It truly is a wonderful guide to the proper arrangement of the medical facilities necessary to the doctor's practice.

**CARE OF THE LONG-TERM PATIENT.** Chronic Illness in the United States. Vol. II. Commission on Chronic Illness. Cloth. Price, \$8.50. Pp. 606. Harvard University Press, Cambridge, Mass., 1956.

This volume represents a great amount of work by many people from almost as many disciplines. It is a report of the Commission on Chronic Illness concerning the long-term patient and the first of four such volumes to be published. Scheduled for publication are I: Prevention of Chronic Illness; III: Chronic Illness in a Rural Area; IV: Chronic Illness in a Large City. Volume II will serve best when used as a reference book.

This book is well documented by tables and some graphic material. There are nine chapters that deal with care of the long-term patient at home and in institutions by various types of personnel. The problems of coordinating services and establishing research programs are discussed. There is adequate recognition of the problem of cost of care for long-term illness, and there is a splendid presentation concerning methods available and methods that might be available to cover these costs. Training of essential personnel is covered.

Seven appendices are complete with valuable information. This volume represents col-

lected and coordinated effort from sources that are beyond calculation. The authors are legion. It is not a book that can be read. It should be readily available to every physician and to every member of the vast number of our co-professional associates.

There will be more long-term illness in the years to come, and anyone with an interest in our national economy must be familiar with the subject material contained in this book.

The remaining three volumes of the series must aim high to maintain the standard that has been developed in this report.

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**FIRST STUDIES IN ANATOMY AND PHYSIOLOGY.** By *John Cairney, M.D.*, and *John Cairney, B.Sc., M.B., Ch.B.* Cloth. Price, \$4.25. Pp. 205, with illustrations. N. M. Peryer, Ltd., 145-147 Worcester St., Christchurch, New Zealand, 1956.

This book is intended for practical nurses and other persons in the paramedical areas with little time or need for such preparation in basic medical science as is required by registered nurses.

The authors are to be admired for condensing a vast material into such simple and well-balanced fundamentals. No gross errors were detected. The illustrations are clear and correct.

Such a volume might well serve a purpose in pre-university studies as well as by rehabilitation counselors, social workers, and other such persons requiring a basic orientation to medicine.

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**RECENT PROGRESS IN HORMONE RESEARCH.** The Proceedings of the Laurentian Hormone Conference, Vol. XII. Edited by *Gregory Pincus.* Cloth. Price, \$10.00. Pp. 453, with illustrations. Academic Press, Inc., Publishers, 111 Fifth Ave., New York 3, 1956.

This book, the proceedings of the Laurentian Conference of 1955 (Estes Park, Colo.), presents current hormonology from the basic science point of view. The development of new research tools for separation and identification of difficult compounds such as the steroids has enormously speeded the progress of knowledge of biological chemistry. The most important of the newer processes are separation of cell constituents by ultracentrifugation and paper chromatography combined with radioautography. Infrared and ultra-violet absorption spectra, optical rotation, fluorescence and other physical properties help complete identification. Chemists are able to examine the processes of individual cell constituents such as microsomes and mito-

chondria and have steadily reduced the amounts of material needed for quantitative analysis from milligrams to micrograms.

In each hormone field the patient unraveling of intermediate hormone compounds, always involving enzymes, brings out some surprises. The family of iodotyrosines is an example—one of the triiodotyrosines is said to be ten times as active as the tetraiodo form, which we always thought of as *Thyroxin* per se. In the adrenal cortex a compound like progesterone may exist in a hormonologically inactive, intracellular compartment, merely as a precursor of some other steroid. The search for the mechanism of ACTH in releasing corticoids is narrowing down but eludes final description. As always in this difficult field, keeping track of terminology and the newer abbreviations is nerve-wracking. A single chapter by Dr. Escamilla reviews the chief clinical syndromes of endocrine medicine. The work is highly recommended as a post graduate course in endocrinology.

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**POSTURAL AND RELAXATION TRAINING IN PHYSIOTHERAPY AND PHYSICAL EDUCATION.** By *John H. C. Colson.* Cloth. Price, \$2.50. Pp. 105, with illustrations. Charles C. Thomas, Publisher, 301-327 E. Lawrence Ave., Springfield, Ill., 1956.

Part I of this book deals with the re-education of posture for children and would be of value to a teacher of physical education in a school situation. Some of the exercises described would be difficult for an adult, or severely handicapped child, to perform. The approach to the problems of posture is the usual one.

Part II is concerned with relaxation training. The gradation of the training technics is excellent and could be readily used by anyone interested in the relief of tensions. The chapter on "So-called Psychosomatic Tension States" gives in a clear concise style, the psychological aspects of the problem, defense mechanisms and clinical manifestations with stages of treatment.

The book is well illustrated making it easy to understand the material, and merits a place in the professional library of a physical therapist or physical educator.

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**SILENT SPOKESMAN.** An Aid to the Speechless. By *Wayland W. Lessing.* Paper. Price, \$1.50. Pp. 35, with illustrations. Hospital Topics, 30 W. Washington St., Chicago 2, 1956.

In his introduction, the author states that his book is "a communication bridge for persons whose power of oral and written expres-

sion has been impaired, or destroyed, by illness, injury, or disease." Since the care and treatment of the aphasia patient is costly in terms of the time, effort and patience on the part of the doctor, nurse and therapist, any method which appears to have merit should be given a fair trial.

Before a true evaluation of the method can be made it should be subjected to the scientific method of inquiry. However, the author has prepared an interesting book, which progresses from pictorial description of basic necessities to broader groupings and meanings; for example, he goes into words of measure and degree, and makes it possible for the patient to express opinions as well as making his basic needs known.

The first section contains pictures of "personal needs" such as pillow, doctor and nurse. The second section is concerned with "food" and the third, deals with "clothing." Other sections cover "general requests," "general questions," "financial" and, many other items essential to communication. The author has not attempted to prepare a complete pictorial list but has included only enough items to make it possible for the patient to make his needs known. The speech therapist should find this volume a valuable addition to his library. In addition to professionally trained personnel, the friends and relatives of the home-bound aphasia patient will find many uses for the book.

**THE PSYCHOLOGY OF SEX OFFENDERS.** By *Albert Ellis, Ph.D., and Ralph Brancato, M.D.* Cloth. Price, \$3.75. Pp. 132. Charles C Thomas, Publisher, 301-327 E. Lawrence Ave., Springfield, Ill., 1956.

The study reported is based on 300 consecutive convicted cases of sex offense examined at the New Jersey State Diagnostic Center between May, 1949 and June, 1950. Each case was subjected to psychiatric, psychological, and sociological survey performed in a permissive atmosphere in a sincere attempt to find out why the sex offense was committed.

The results are painstakingly examined in relation to 21 hypotheses which had been previously formulated by those who have studied sex offenses. As would be expected, the present study confirms many of these hypotheses but appears to repudiate a few.

The authors suggest a new classification of sex offenses based on terminology which is clearly understandable and divided into enough sub-groupings to permit intelligent evaluation. Terms such as "carnal abuse," "open lewdness," etc., are subject to such wide variation in usage as to be practically useless in comparative studies. About one-third of convicted sex offenders exhibited alcoholism as an associated or as a triggering

mechanism. About 45 per cent of convicted sex offenders have subnormal intelligence, while nine per cent were found in the bright normal or superior classification. An excellent and brief summary of the major findings and recommendations is provided in chapter six.

An interesting appendix includes three thought provoking articles concerning the characteristics of convicted sex offenders; the interrogations of sex offenders; and finally "What is Normal Sex Behavior?"

This book is certain to be of interest to physicians, therapists, psychologists, social workers, and criminologists. As a pattern for enlightened legislation and rehabilitative management for sex offenders, this book should be of value to legislators and other community-minded citizens.

**OBSERVATIONS ON KREBIOZEN IN THE MANAGEMENT OF CANCER.** By *A. C. Ivy, Ph.D., M.D., John F. Pick, M.D., and W. F. P. Phillips, M.D.* Cloth. Price, \$2.50. Pp. 88, with illustrations. Henry Regnery Company, Chicago, 1956.

This compact little monograph is extolled as "an entirely objective and scientific book written by medical scientists in search of the truth." The authors' foreword is prefaced by quotations of a philosophical bent including two from Claude Bernard: "Medicine must begin as a simple clinical observation," and "If a subject is dark and unexplored, the physiologist should not be afraid to act at random—(or) to fish in troubled waters."

The authors hope to stimulate study of the mechanisms by which the body resists the formation and growth of cancer while describing what is known about a remedy believed to be of value in the management of cancer. Seven chapters take the reader through the theory preparation toxicity and treatment results of Krebiozen in selected patients—a series of tables summarize patient statistics in 588 cases. Typical, it seems, of this type of publication is the author-publishers' list of errata accompanying the booklet. It adds little to the current literature on cancer therapy except perhaps to provoke speculation on growth rate doubling time as mechanisms in cancer disease.

**THE NATURE OF BRUCELLOSIS.** By *Wesley W. Spink, M.D.* Cloth. Price, \$8.00. Pp. 464, with illustrations. University of Minnesota Press, Minneapolis 14, 1956.

As the author says, this is the autobiography of a laboratory and clinic, and the biography of a disease. Dr. Spink and his co-workers have devoted a great deal of time to the study of this disease. It is most interesting reading, even to one who is only casually interested in brucellosis. David Bruce, at the age of 28, was responsible for the medical care of 2200



troops garrisoned on Malta, and his major task was to care for soldiers ill with Malta fever. He cultured a micrococcus which was named *micrococcus melitensis*, but the recognition that the host is the goat was not realized until early in the twentieth century. Abortion in cattle led to the discovery of microorganisms between the fetal membranes and the uterus. Bang of Copenhagen established *Bacillus abortus* as the cause. A strain was also found in hogs (Suis). Alice Evans recognized that the micrococcus of Bruce and the *Bacillus* of Bang all belonged to the same family, and this cell was given the name "*Brucella*," distinguishing it from either a coccus or a *Bacillus*. Fevers due to this organism, and recognized by various names, go back to ancient times in the Mediterranean countries.

It is a most important disease since it affects the economy of man, as well as his health. The epidemiology, the pathogenesis, the natural course, the complications, the diagnosis, and the treatment and prevention are all carefully discussed. Since it is a disease that has spread over the entire world wherever animal husbandry is of importance, its recognition is required of veterinarians and doctors of medicine. The great problem remains of eradicating the disease. This is particularly difficult since it is an intra-cellular organism.

Since the disease is manifest in so many different ways, a knowledge of this disease is of importance to all doctors of medicine.

**CEREBRAL PALSY.** *Advances in Understanding and Care.* By *Viola E. Cardwell*, R.N. Cloth. Price, \$5.00. Pp. 625, with illustrations. Association for the Aid of Crippled Children, 345 E. 46th St., New York 17, 1956.

Miss Viola Cardwell has performed a worthy task in attempting to review the vast literature in the myriad facets of this complex subject of cerebral palsy. She has covered the main aspects of this problem, intelligently organized the material, and provided an extensive bibliography for the reader.

The author has undertaken a very ambitious task. The subject of cerebral palsy is one of the most poorly understood, disorganized and diffuse in medicine.

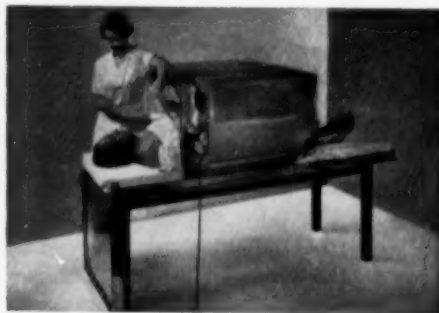
In the introduction to this text, the author states that her aim has been "to create a book suitable for use in university courses and for study or reference by practitioners in the various professions and other individuals who would be interested in and could profit by the material presented herein." When Miss Cardwell directs the book to physician and non-physician, to student and teacher, to parent and patient, she compounds the problem.

#### DIAGNOSIS AND TREATMENT OF PERIPHERAL VASCULAR DISORDERS.

*David I. Abramson*, M.D. Cloth. Price, \$13.50. Pp. 537, with illustrations. Paul B. Hoeber, Inc., Medical Book Dept. of Harper & Bros., 49 E. 33rd St., New York 16, 1956.

This textbook on peripheral vascular disorders is written by a doctor of medicine for the general practitioner. Hence surgical matters are discussed mostly from the standpoint of indications and results. The techniques are not considered except such as can be performed by a trained general physician. Many physiatric procedures are mentioned but the techniques are left in the hands of qualified physical medicine and rehabilitation personnel.

The book is divided into three parts. Part I deals with differential diagnosis of symptoms and signs of peripheral vascular disease such as pain and ulceration; and discusses the technical procedures helpful in their differentiation. Part II, the major part of the book, deals with disease entities, etiology, diagnosis, prognosis and treatment. Part III gives the anatomic, physiologic and pathologic implications of peripheral, vascular disorders. Twelve tables, mostly on differential diagnosis add to the value of this book.



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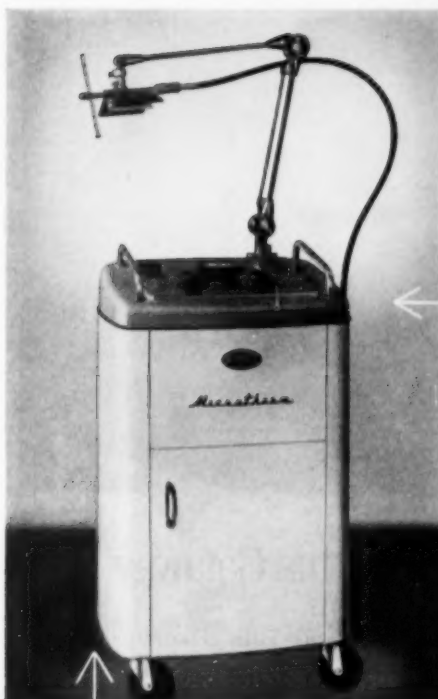
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\*Martin, G. M., and Herrick, J. F.: Further Evaluation of Heating by Microwave and by Infra-red as Used Clinically, J.A.M.A. 159:1286 (Nov. 26) 1955.



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House died, her little grandniece, seeing hundreds of children among the mourners, asked, "Are we all Aunt Jane's children?"

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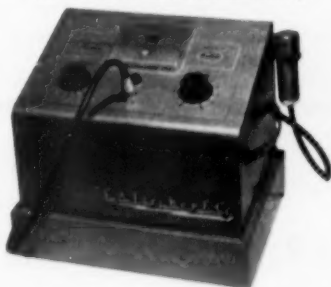
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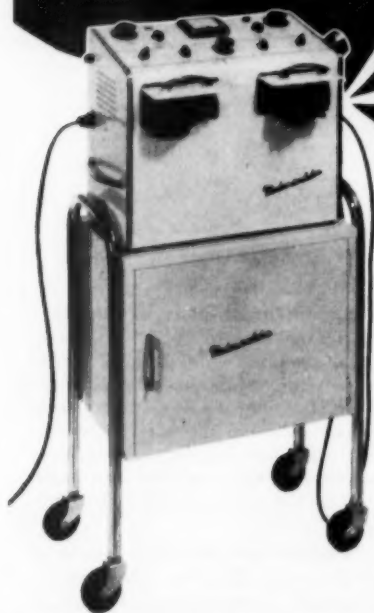


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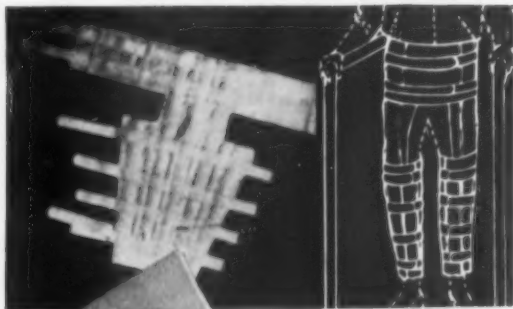
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*Left to Right: Hector Aguilar, Don Emmons, Bob Weller, John Ridley, Olgie Krzyzanowski, Jack Gardner, Chief of Research Dept., Hod Finch, Bill Cobleigh; Seated, Bernice Schiada.*

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I present to you here a photograph; not really a posed one nor even professionally taken. It's a snapshot that I took of a group of engineers in our Research and Development Department. They have nothing to do with production. They are engineers who devote their lives to design, development and proving their convictions are right, under a policy of management that insists it must be the best we can conceive regardless of cost or eventual selling price. These people

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